

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 321)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in February 1989 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*



National Aeronautics and Space Administration
Office of Management
Scientific and Technical Information Division
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INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* lists 137 reports, articles and other documents announced during February 1989 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of the bibliography was published in July 1964.

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. In general, emphasis is placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the bibliography consists of a bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR*, including the original accession numbers from the respective announcement journals. The *IAA* items will precede the *STAR* items within each category.

Seven indexes — subject, personal author, corporate source, foreign technology, contract, report number, and accession number — are included.

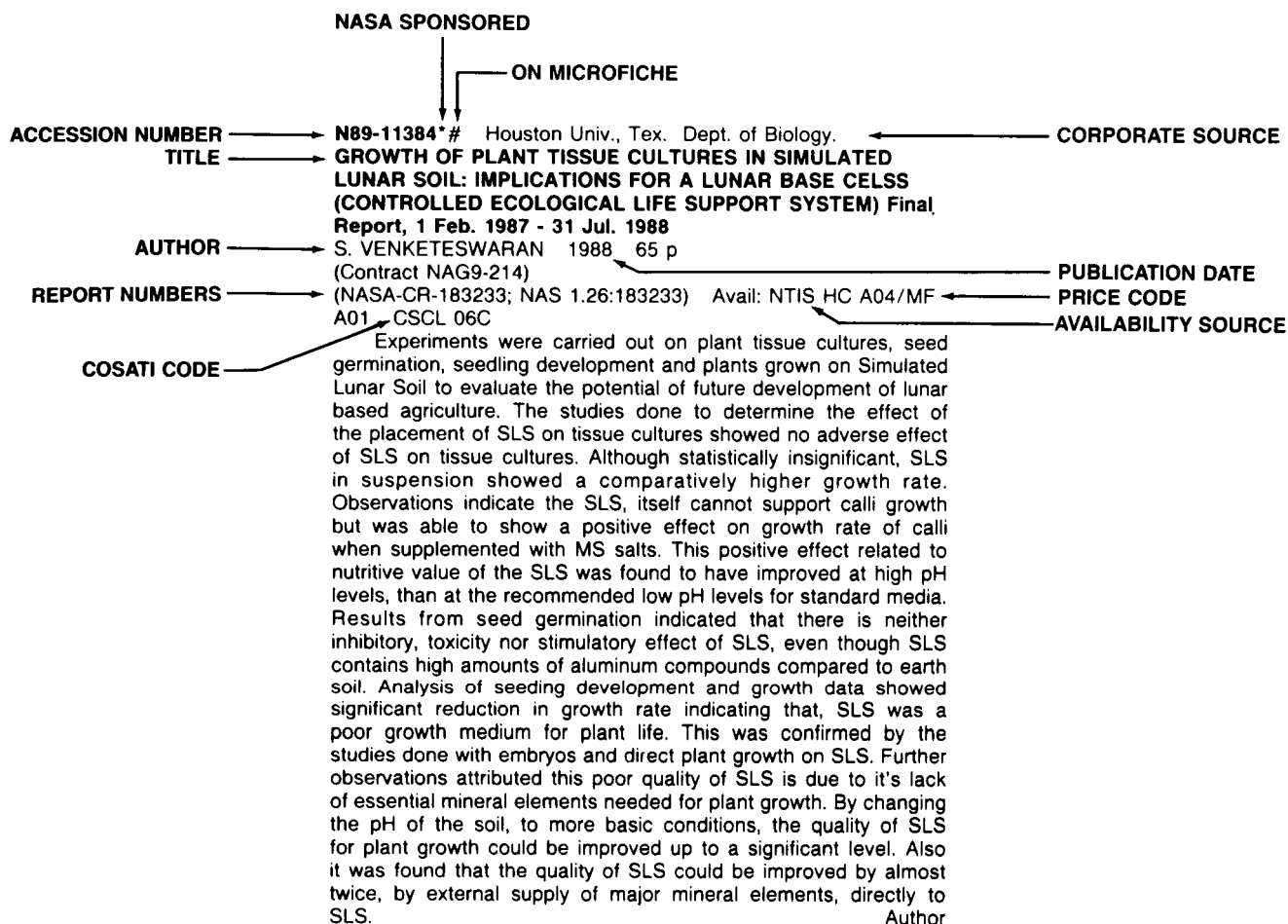
An annual index will be prepared at the end of the calendar year covering all documents listed in the 1989 Supplements.

Information on the availability of cited publications including addresses of organizations and NTIS price schedules is located at the back of this bibliography.

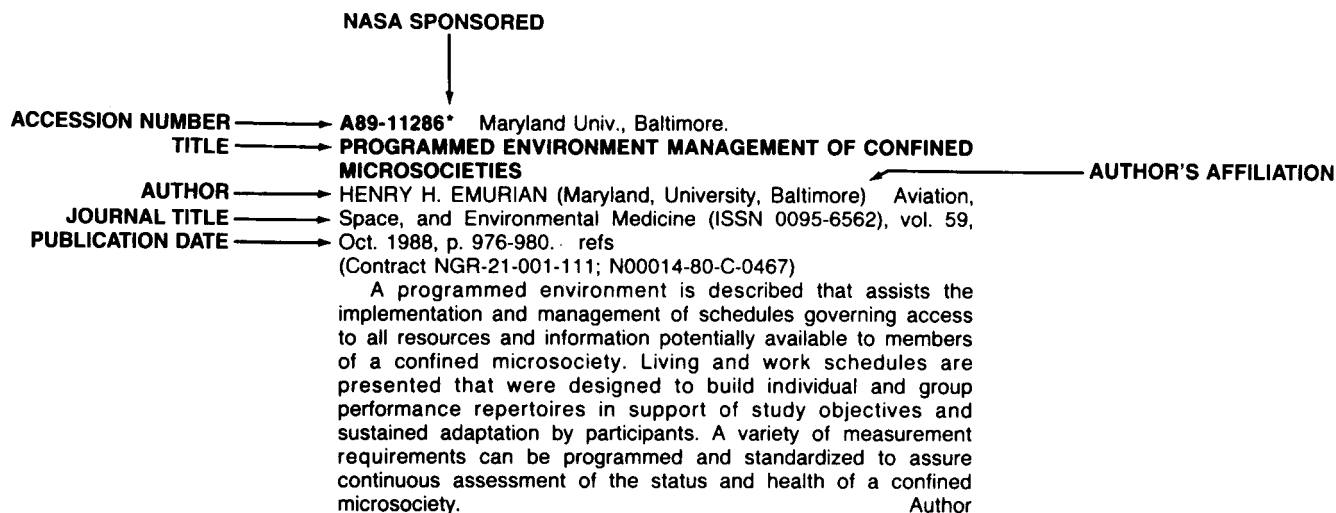
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TYPICAL REPORT CITATION AND ABSTRACT



TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT



AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 321)

MARCH 1989

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LIFE SCIENCES (GENERAL)

A89-12875

ELECTRONMICROSCOPIC STUDIES OF ALVEOLAR MACROPHAGES FROM GAMMA-RAY IRRADIATED GUINEA PIGS

KH. KRUSTEV, KH. M. NAIDENSKI, D. K. VELIANOV, and S. A. RODOEVSKA (B'lgarska Akademiia na Naukite, Institut po Mikrobiologiya, Sofia, Bulgaria) Bolgarskaia Akademiia Nauk, Doklady (ISSN 0366-8681), vol. 41, no. 8, 1988, p. 141-144. refs

A89-13324

RADIOPROTECTIVE ACTIVITY OF NATURAL CAROTENE-CONTAINING PREPARATIONS - TESTING OF BETA-CAROTENE IN ALBINO RATS [RADIOZASHCHITNOE DEISTVIE PRIRODNYKH KAROTINSODERZHASHCHIKH PREPARATOV: ISSLEDOVANIE KAROTINILA NA BELYKH KRYSAKH]

M. M. VILENCHIK, T. I. GIKOSHVILI, A. M. KUZIN, IU. I. MOSKALEV, S. V. STEPANOV (AN SSSR, Institut Biologicheskoi Fiziki, Institut Biofiziki, Moscow; Krasnodarskii Kombinat Biokhicheskikh i Vitaminnykh Preparatov, Krasnodar, USSR) et al. Radiobiologiya (ISSN 0033-8192), vol. 28, July-Aug. 1988, p. 542-544. In Russian. refs

A89-13325

BODY MASS CHANGE IN RATS EXPOSED TO MICROWAVES OF NONTHERMAL INTENSITY [IZMENENIE MASSY TELA KRYSA V PROTSESSE OBLUCHENIIA MIKROVOLNAMI NETEPLOVOI INTENSIVNOSTI]

I. V. KOVESHNIKOVA and E. N. ANTIPENKO (Kievskii Nauchno-Issledovatel'skii Institut Obshchei i Kommunal'noi Gigieny, Kiev, Ukrainian SSR) Radiobiologiya (ISSN 0033-8192), vol. 28, July-Aug. 1988, p. 561-563. In Russian. refs

A89-14521* Texas Univ., Houston.

EFFECT OF THE TRENDLENBURG POSITION ON THE DISTRIBUTION OF ARTERIAL AIR EMBOLI IN DOGS

BRUCE D. BUTLER (Texas, University, Houston), GLEN A. LAINE, BASIL C. LEIMAN, DAVE WARTERS, MARK KURUSZ (Texas, University, Houston and Galveston) et al. Annals of Thoracic Surgery (ISSN 0003-4975), vol. 45, Feb. 1988, p. 198-202. Research supported by the American Society of Anesthesiology. refs
(Contract NAG9-215; NIH-HL-36115)

The effect of Trendelenburg position (TP) on the distribution of arterial air emboli in dogs was examined in a two-part investigation. In the first part, the effects of the bubble size and the vessel angle on the bubble velocity and the direction of flow were investigated in vitro, using a simulated carotid artery preparation. It was found that larger bubbles increased in velocity in the same direction as the blood flow at 0-, 10-, and 30-deg vessel angles, and decreased when the vessel was positioned at

90 deg. Smaller bubbles did not change velocity from 0 to 30 deg, but acted to increase the velocity, in the same direction as the blood flow, at 90 deg. The second series of experiments examined the effect of 0 to 30 deg TP on carotid-artery distribution of gas bubbles injected into the left ventricle or ascending aorta of anesthetized dogs. It was found that, regardless of the degree of the TP, the bubbles passed into the carotid artery simultaneously with the passage into the abdominal aorta. It is concluded that the TP does not prevent arterial bubbles from reaching the brain. I.S.

A89-14522* Arizona Univ., Tucson.

INSULIN EFFECT ON AMINO ACID UPTAKE BY UNLOADED RAT HINDLIMB MUSCLES

S. R. JASPERS and M. E. TISCHLER (Arizona, University, Tucson) Hormone and Metabolic Research (ISSN 0018-5043), vol. 20, Feb. 1988, p. 125, 126. refs
(Contract NAGW-227; NAG2-384)

The effect of insulin on the uptake of alpha-amino-isobutyric acid (AIB) by unloaded rat hindlimb muscles was investigated using soleus and extensor digitorum longus (EDL) muscles from intact and adrenalectomized (ADX) rats that were tail-casted for six days. It was found that, at insulin levels above 0.00001 units/ml, the in vitro rate of AIB uptake by muscles from intact animals was stimulated more in the weight bearing muscles than in unloaded ones. In ADX animals, this differential response to insulin was abolished. I.S.

A89-14723

MEASUREMENTS OF K(+), H(+), AND CL(-) FLOWS ACROSS THE MEMBRANE OF ERYTHROCYTES IRRADIATED BY ELECTROMAGNETIC RADIATION IN THE RF RANGE [ISSLEDOVANIE POTOKOV K/+, H/+ I CL-/ CHEREZ MEMBRANU ERITROTSITOV, OBLUCHENNYKH ELEKTROMAGNITNYM IZLUCHENIEM RADIOCHASTOTNOGO DIAPAZONA]

IU. A. KIM, IU. V. KIM, I. K. KASIMBEKOV, and B. S. FOMENKO (AN SSSR, Institut Biologicheskoi Fiziki, Pushchino, USSR) Biofizika (ISSN 0006-3029), vol. 33, Sept.-Oct. 1988, p. 837-840. In Russian. refs

A89-14724

THE AMPLITUDE-FREQUENCY MODULATION OF THE ELECTROENCEPHALOGRAMS RELATED TO RHYTHMIC MOVEMENTS [AMPLITUDNO-CHASTOTNAIA MODULIATSIYA ELEKTROENTSEFALOGRAMMY, SVIAZANNAIA S RITMICHESKIMI DVIZHENIAMI]

S. R. GUTMAN, A. B. TREMBACH, and S. V. FOMICHENKO (Krasnodarskii Gosudarstvennyi Institut Fizicheskoi Kul'tury, Krasnodar, USSR) Biofizika (ISSN 0006-3029), vol. 33, Sept.-Oct. 1988, p. 860-862. In Russian. refs

A89-14800* Texas Univ., Houston.

VASCULAR PRESSURES AND PASSAGE OF GAS EMBOLI THROUGH THE PULMONARY CIRCULATION

B. D. BUTLER and J. KATZ (Texas, University, Houston) Undersea Biomedical Research (ISSN 0093-5387), vol. 15, no. 3, 1988, p. 203-209. refs

(Contract NAG9-215)

Doppler technique was used to measure the pulmonary vascular

pressure gradients in dogs that received venous air emboli (VAE) at the rate of 0.35 ml/kg per min, at which the spillover of bubbles into the systemic arteries occur. It was found that, in 60 percent of dogs, venous bubbles spilled over into the arterial circulation at the pulmonary vascular pressure gradient of about 34.7 mm Hg. When the pulmonary vascular pressure gradient was raised to about 52 mm Hg, the spillover of venous bubbles occurred 100 percent of time. It is concluded that venous bubbles can cross the lungs of anesthetized dogs when the driving pressures are sufficient to overcome the normal filtering function. I.S.

A89-16275 State Univ. of New York, Brooklyn.
**ENDOCYTOSIS, PROTEOLYSIS, AND EXOCYTOSIS OF
 EXOGENOUS PROTEINS BY CULTURED MYOTUBES**

RICHARD A. JANECKO, RITA M. CARRIERE, and JOSEPH D. ETLINGER (New York, State University, Brooklyn) *Journal of Biological Chemistry* (ISSN 0021-9258), vol. 260, June 10, 1985, p. 7051-7057. Research supported by the Muscular Dystrophy Association, Hirschl Trust, NIH, and NASA. refs

The endocytic activity of chick myotubes in cultures is studied. The degradation of labeled protein, the rate of proteolysis, the effects of lysomotropic agents such as methylamine, monensin, and chloroquine, and the degradation of endocytosed hemoglobin A and endogenous myotube proteins are investigated. It is suggested that cultured myotubes possess a coupled endocytic/exocytic pathway for macromolecules and that a fraction of the internalized substrate is degraded by an insulin-insensitive lysosomal pathway. R.B.

A89-16530* State Univ. of New York, Brooklyn.
**INHIBITION OF INTRACELLULAR PROTEOLYSIS IN MUSCLE
 CULTURES BY MULTIPLICATION-STIMULATING ACTIVITY**

RICHARD A. JANECKO and JOSEPH D. ETLINGER (New York, State University, Brooklyn) *Journal of Biological Chemistry* (ISSN 0021-9258), vol. 259, May 25, 1984, p. 6292-6297. Research supported by the Muscular Dystrophy Association and Hirschl Trust. refs
 (Contract NAG2-162; NIH-5-R01-HL-21970)

The effects of the insulin-like growth factor, multiplication-stimulating activity (MSA), on chick myotube cultures are studied. The results indicate that MSA is an effective anabolic agent regulating protein metabolism and amino acid uptake, but not sugar transport. Similar size effects on protein metabolism and amino acid uptake in serum-free media were observed in parallel studies with insulin, although insulin levels well in excess of the normal physiological range are required to produce significant effects. It is suggested that there is a generally low insulin sensitivity in cultured chick myotubes relative to adult tissues. R.B.

A89-16531* State Univ. of New York, Brooklyn.
**REGULATION OF PROTEIN DEGRADATION IN MUSCLE BY
 CALCIUM**

RICHARD J. ZEMAN, TSUNEO KAMEYAMA, KAZUE MATSUMOTO, PAUL BERNSTEIN, and JOSEPH D. ETLINGER (New York, State University, Brooklyn) *Journal of Biological Chemistry* (ISSN 0021-9258), vol. 260, Nov. 5, 1985, p. 13619-13624. Research supported by the Muscular Dystrophy Association and Hirschl Trust. refs
 (Contract NAG2-162; NIH-5-R01-HL-21970; NIH-HL-31494)

Calcium-dependent regulation of intracellular protein degradation was studied in isolated rat skeletal muscles incubated in vitro in the presence of a large variety of agents known to affect calcium movement and distribution. The effect of different classes of protease inhibitors was tested to determine the responsible proteolytic systems involved in calcium-dependent degradation. The results suggest that nonlysosomal leupetin- and E-64-c-sensitive proteases are responsible for calcium-dependent proteolysis in muscle. R.B.

A89-16626
**METHODOLOGY OF ANALYZING FLUCTUATING PROCESSES
 IN BIOSYSTEMS [METODOLOGIJA ANALIZA
 KOLEBATEL'NYKH PROTSESSOV V BIOSISTEMAKH]**

A. K. GALITSKII (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) *Kibernetika i Vychislitel'naia Tekhnika* (ISSN 0454-9910), no. 74, 1987, p. 25-32. In Russian. refs

This paper discusses various methodologies used in the analysis of rhythmic bioprocesses, with special attention given to the comparison of the probabilistic and the deterministic methodologies. The advantage of using deterministic methods for the analysis of these processes is demonstrated using a concrete example of fluctuating weight increments in preschool children. I.S.

A89-16627

**A MODEL OF HEAT EXCHANGE IN THE ORGANISM, AND ITS
 QUALITATIVE AND NUMERICAL ANALYSIS [OB ODNOI
 MODELI TEPLOOBMENA V ORGANIZME, EE
 KACHESTVENNOM I CHISLENNOM ANALIZE]**

IU. N. ONOPCHUK, D. I. MARCHENKO, and N. G. LOZICHUK (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) *Kibernetika i Vychislitel'naia Tekhnika* (ISSN 0454-9910), no. 74, 1987, p. 56-59. In Russian. refs

A mathematical model for heat exchange in the human organism is presented together with its qualitative analysis. The model is applied to describe heat balance between lungs and various tissue reservoirs. It is shown that the systems regulating heat exchange are closely connected with the respiration regulatory system. I.S.

N89-12166* Lockheed Engineering and Sciences Co., Washington, D.C.

USSR SPACE LIFE SCIENCES DIGEST, ISSUE 19

LYDIA RAZRAN HOOKE, ed., P. LYNN DONALDSON, ed., RONALD TEETER, ed., VICTORIA GARSHNEK, ed., and JOSEPH ROWE, ed. (Library of Congress, Washington, D. C.) Washington NASA Oct. 1988 121 p
 (Contract NASW-4292)

(NASA-CR-3922(22); NAS 1.26:3922(22)) Avail: NTIS HC A06/MF A01 CSCL 06C

This is the 19th issue of NASA's USSR Space Life Sciences Digest. It contains abstracts of 47 papers published in Russian language periodicals or presented at conferences and of 5 new Soviet monographs. Selected abstracts are illustrated with figures and tables from the original. Reports on two conferences, one on adaptation to high altitudes, and one on space and ecology are presented. A book review of a recent work on high altitude physiology is also included. The abstracts in this issue have been identified as relevant to 33 areas of space biology and medicine. These areas are: adaptation, biological rhythms, biospherics, body fluids, botany, cardiovascular and respiratory systems, cytology, developmental biology, endocrinology, enzymology, biology, group dynamics, habitability and environmental effects, hematology, human performance, immunology, life support systems, man-machine systems, mathematical modeling, metabolism, microbiology, musculoskeletal system, neurophysiology, nutrition, operational medicine, perception, personnel selection, psychology, radiobiology, and space biology and medicine. Author

N89-12167* Rockefeller Univ., New York.

**VESTIBULAR REFLEXES OF OTOLITH ORIGIN Final
 Technical Report, 1 Apr. 1979 - 31 Dec. 1987**

VICTOR J. WILSON 27 Oct. 1988 14 p

(Contract NSG-2380)

(NASA-CR-183309; NAS 1.26:183309) Avail: NTIS HC A03/MF A01 CSCL 06C

The vestibular system and its role in the maintenance of posture and in motion sickness is investigated using cats as experimental subjects. The assumption is that better understanding of the physiology of vestibular pathways is not only of intrinsic value, but will help to explain and eventually alleviate the disturbances caused by vestibular malfunction, or by exposure to an unusual environment such as space. The first project deals with the influence on the spinal cord of stimulation of the vestibular labyrinth, particularly the otoliths. A second was concerned with the properties and neural basis of the tonic neck reflex. These two projects are related, because vestibulospinal and tonic neck reflexes interact in the maintenance of normal posture. The third project began with an

interest in mechanisms of motion sickness, and eventually shifted to a study of central control of respiratory muscles involved in vomiting. Author

N89-12168# Montana State Univ., Bozeman. Dept. of Chemistry.

MECHANISM OF CONVERSION OF LIGHT INTO CHEMICAL ENERGY IN BACTERIORHODOPSIN: IDENTIFICATION OF CHARGE MOVEMENTS AND COUPLING TO ACTIVE SITE CONFORMATIONAL CHANGES Annual Report, Apr. 1987 - Jun. 1988

EDWARD A. DRATZ 30 Jun. 1988 9 p

(Contract N00014-87-K-0278; PROJ. RR0-4108)

(AD-A196624) Avail: NTIS HC A02/MF A01 CSDL 06A

Bacteriorhodopsin is the best understood transmembrane ion pump. Bacteriorhodopsin creates ca. 100 mV transmembrane potential by pumping protons across its membrane when illuminated by visible light. Visible light isomerizes a small (ca. 300 Dalton) chromophore called retinal which drives protein conformational changes that accomplish the pumping. Pumping occurs in a series of steps, and the intermediate forms can be trapped for study at sufficiently low temperatures. New methods of solid state NMR have recently provided striking new information on the detailed structure of the retinal active site in bacteriorhodopsin. However, the light induced changes that produce transmembrane proton pumping have not been studied. Experiments underway are designed to reveal the light induced conformational changes at the active site, the light induced charge movements, and the coupling of the charge motion to the active site conformational changes in bacteriorhodopsin using new solid state NMR methods. GRA

N89-12169# Catholic Univ. of America, Washington, DC. Dept. of Physics.

TRANSIENT INTERACTION OF ELECTROMAGNETIC PULSES IN DIELECTRICS AND MICROWAVE BIOPHYSICS Final Report, 1 Jun. 1985 - 30 May 1988

THEODORE C. GUO and WENDY W. GUO 12 May 1988 70 p

(Contract N00014-85-K-0475)

(AD-A196838; REPT-5-88-WRAIR/ONR) Avail: NTIS HC

A04/MF A01 CSDL 06G

Due to recent progress in developing equipments that can generate short microwave and millimeter wave pulses, there has been an increasing proliferation of microwave pulse transmitters, some with short pulse width (0.1 microsecond) and extremely high intensity (100 to 1000 megawatts). Microwave pulse transmitters are used extensively by the military for communication and remote control; using microwave pulses as directive energy weaponry and as means of transporting energy has also been contemplated. Electromagnetic pulses (EMP) are also emitted in nuclear blasts and from EMP simulators. All this production of microwave pulses affects the operation of military personnel in non-combat environment as well as in battle fields. Therefore minimizing microwave damage is central to successful operations of all military units. Understanding basic interactions between microwave pulses and dielectric materials will contribute greatly to the protection of human subjects from microwave damage and to the development of preventive measure. GRA

N89-12170# Colorado Univ., Boulder. Dept. of Electrical and Computer Engineering

EFFECTS OF ULTRASOUND PULSING ON NEURAL EXCITABILITY Annual Report, 1 Apr. 1987 - 30 Jun. 1988

H. WACHTEL and R. MIHRAN 30 Jun. 1988 7 p

(Contract N00014-87-E-0313; PROJ. RR0-4108)

(AD-A197492) Avail: NTIS HC A02/MF A01 CSDL 06G

We have used brief bursts of relatively low intensity ultrasound (US) to alter the excitability of myelinated fibers within the frog sciatic nerve. The magnitude and direction of these changes are critically dependent on the timing of the burst relative to the electrical stimulus and are different for various fiber types and frog species. These effects cannot be emulated using equivalently timed electrical pre-stimuli and cannot be attributed to electrode

artifacts. Since temperature rises of less than 0.01 C accompany effective US bursts and the levels are far below those causing cavitation, the effect is thought to be of a direct micromechanical nature. A selective activation or repression of slow conductance channels would, at this juncture, appear to be the most plausible explanation for these effects. GRA

N89-12769# Ohio State Univ., Columbus. Dept. of Exercise Physiology and Physiological Chemistry.

ALTERATIONS OF SEGMENTAL VOLUME DURING ORTHOSTATIC STRESS IN NONHUMAN PRIMATES Final Report

BEVERLY ELAINE GIRTEN In Universal Energy Systems, Inc., United States Air Force Graduate Student Summer Support Program, Volume 1 20 p Dec. 1987

Avail: NTIS HC A99/MF E03 CSDL 06P

The effect of exposure to short-term simulated weightlessness on the volume changes that occur in young adult nonhuman primates is investigated. A series of experiments involving head-up and head-down tilt protocols were conducted to test feasibility of using impedance plethysmographic equipment and procedures to define segmental volume changes in Rhesus monkeys. The specific objectives involved monitoring the calf, thigh, pelvic, abdominal and thoracic volumes prior to, during, and following exposure to short-term orthostatic and antiorthostatic stress. Initial work on this project involved preliminary testing of the data recording system. Four adult male Rhesus monkeys were tested during this phase, and impedance plethysmography was utilized to determine segmental volume changes. Ten animals were tested during the primary experiment. The data obtained indicated that fluid exchange between the peripheral and the more head-up or head-down, and the redistribution seems to be graded and a function of the angle of tilt. These results suggest that the peripheral arterial/venous system is able to compensate for mild stresses produced by low angles of head-up and head-down tilt; however, it is not able to maintain this compensation during or following the higher angles of tilt. Author

N89-12772# Meharry Medical Coll., Nashville, Tenn. Dept. of Biomedical Sciences.

THE EFFECTS OF HYPERBARIC OXYGEN AND ANTIOXIDANT DEFICIENCIES ON RAT RETINAL ULTRASTRUCTURE Final Report

ADRIENNE L. HOLLIS In Universal Energy Systems, Inc., United States Air Force Graduate Student Summer Support Program, Volume 1 19 p Dec. 1987

Avail: NTIS HC A99/MF E03 CSDL 06C

It was shown previously that the electro-physiological response of the rat retina is rapidly diminished in animals fed diets deficient in both vitamin E and selenium for 6 weeks and treated with hyperbaric oxygen (HBO). Animals deficient in vitamin E alone also show diminished electroretinograms but only after prolonged hyperbaric oxygen treatment. Through quantitative histopathological studies, damage to the retinal pigment epithelial layer as well as the outer nuclear layer has been observed in animals fed a diet for 15 weeks that was deficient in vitamin E only. The alterations in retinal tissues observed by electrophysiology and quantitative histopathology should correlate with ultrastructural studies. In this study, we have prepared retinal tissue samples for electron-microscopy studies and have obtained electron micrographs for future cytopathological analyses. The parameters to be studied include outer segment disk membrane deterioration, lipofuscin content of the RPE, phagosome number in the RPE, separations between tips of photoreceptors and apical surface of RPE, and migration of photoreceptor cells into the inner retina. Author

N89-13130# Massachusetts Inst. of Tech., Cambridge. Harvard-MIT Div. of Health Sciences and Technology.

ELECTROPORATION: THEORY OF BASIC MECHANISMS Annual Progress Report, 1 Jun. 1987 - 31 May 1988

JAMES C. WEAVER 30 Jun. 1988 3 p

51 LIFE SCIENCES (GENERAL)

(Contract N00014-87-K-0479; RR04108)

(AD-A197391) Avail: NTIS HC A02/MF A01 CSCI 06D

The objective of our investigation is to develop a theory of the mechanism of electroporation, by providing a quantitative description of key features of this dramatic phenomenon. Electroporation is now believed to be a universal cell membrane phenomenon, involving both the lipid bilayer and membrane macromolecules. It provides a general method for introducing molecules into cells, or releasing molecules from cells, with potentially major applications in science and technology, and yet is presently poorly understood. Our specific goals are extension of our first, successful theory of reversible electrical breakdown (REB) to one with more solid foundations, i.e., elimination of the approximate switch on criteria of pores; and development of a theory which describes quantitatively the transmembrane potential, $U(t)$, during irreversible rupture, such that a unified theory of both REB and rupture is provided by one model; extension of our first, successful theory of the reversible electrical breakdown of electroporation to include metastable pores associated with a pore-membrane macromolecule interaction; and development of a more complex theory which also predicts the amount of transmembrane transport of molecules. GRA

N89-13131* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

HORIZONTALLY ROTATED CELL CULTURE SYSTEM Patent Application

DAVID A. WOLF, inventor (to NASA), RAY SCHWARZ, inventor (to NASA), and TINH TRINH, inventor (to NASA) (Krug International, Houston, Tex.) 30 Jun. 1988 17 p (NASA-CASE-MS-21294-1; NAS 1.71:MS-21294-1; US-PATENT-APPL-SN-213558) Avail: NTIS HC A03/MF A01 CSCI 06C

The present invention relates to a horizontally rotating bioreactor useful for carrying out cell and tissue culture. For processing of mammalian cells, the system is sterilized and fresh fluid medium, microcarrier beads, and cells are admitted to completely fill the cell culture vessel. An oxygen containing gas is admitted to the interior of the permeable membrane which prevents air bubbles from being introduced into the medium. The cylinder is rotated at a low speed within an incubator so that the circular motion of the fluid medium uniformly suspends the microbeads throughout the cylinder during the cell growth period. The unique design of this cell and tissue culture device was initially driven by two requirements imposed by its intended use for feasibility studies for three dimensional culture of living cells and tissues in space by JSC. They were compatibility with microgravity and simulation of microgravity in one G. The vessels are designed to approximate the extremely quiescent low shear environment obtainable in space. NASA

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AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

A89-13939

RESPONSES IN MUSCLE SYMPATHETIC ACTIVITY TO ACUTE HYPOXIA IN HUMANS

MITSURU SAITO, TADAAKI MANO, SATOSHI IWASE, KAZUO KOGA, HIROSHI ABE (Nagoya University, Japan) et al. Journal of Applied Physiology (ISSN 0161-7567), vol. 65, Oct. 1988, p. 1548-1552. refs

The effect of hypobaric hypoxia on the muscle sympathetic activity (MSA) in humans was investigated using a direct recording technique to monitor sympathetic nerve activity in subjects participating in a mountaineering training to high altitude. Postganglionic MSA was recorded with the use of a tungsten

microelectrode inserted percutaneously into the muscle nerve fascia of the tibial nerve of subjects exposed to hypoxic conditions at simulated altitudes of 4000, 5000, and 6000 m. The average values of the MSA burst rate and total MSA activity (burst rate times mean burst amplitude) at these altitudes were significantly higher than the values recorded at sea level, indicating that MSA is activated under hypoxia. Heart rate also was found to increase significantly. At 6000 m, there were large interindividual differences in the MSA responsiveness to hypoxia. It is suggested that central controlling mechanisms that would be affected by hypoxia may also influence the MSA responsiveness under severe hypoxia. I.S.

A89-13940* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

ASSOCIATION OF SEX AND AGE WITH RESPONSES TO LOWER-BODY NEGATIVE PRESSURE

MARY ANNE BASSETT FREY and G. WYCKLIFFE HOFFLER (NASA, Kennedy Space Center; Bionetics Corp., Cocoa Beach, FL) Journal of Applied Physiology (ISSN 0161-7567), vol. 65, Oct. 1988, p. 1752-1756. refs

The effects of age and sex on the human-body responses to -50 torr LBNP were investigated in subjects who have undergone LBNP tests at the Kennedy Space Center. The comparison of results obtained on women and age-matched men indicated that men had larger relative increases in calf circumference and greater increases in peripheral resistance during the exposure to LBNP than the women; on the other hand, women displayed greater increases in thoracic impedance and heart rate. The comparison of the results on men of different ages (between 29 and 56 y) indicated that older subjects had greater increases in peripheral resistance and less heart rate elevation in response to LBNP. It is suggested that the age-related circulatory differences were due to a reduction in vagal response and a switch to predominant sympathetic nervous system influence in older men. I.S.

A89-14523* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

DIET AND THE ROLE OF LIPOPROTEINS, LIPASES, AND THYROID HORMONES IN CORONARY LESION GROWTH

JACQUES D. BARTH (California Institute of Technology, Jet Propulsion Laboratory, Pasadena; Saint Radboud University Hospital, Nijmegen, Netherlands), HANS JANSEN, JOHAN H. C. REIBER, JAN C. BIRKENHAGER (Rotterdam, Erasmus Universiteit, Netherlands), DAAN KROMHOUT (Leiden, Rijksuniversiteit, Netherlands) et al. Journal of Cardiovascular Pharmacology Supplement (ISSN 0160-2446), vol. 10, no. 9, 1987, p. S42-S46. refs

The relationships between the coronary lesion growth and the blood contents of lipoprotein fractions, thyroid hormones, and the lipoprotein lipase activity were investigated in male patients with severe coronary atherosclerosis, who participated in a lipid-lowering dietary intervention program. A quantitative computer-assisted image-processing technique was used to assess the severity of coronary obstructions at the beginning of the program and at its termination two years later. Based on absolute coronary scores, patients were divided into a no-lesion growth group (14 patients) and a progression group (21 patients). At the end of the trial, the very-low-density lipoprotein cholesterol and triglycerides were found to be significantly higher, while the high-density lipoprotein cholesterol and hepatic lipase (HL) were lower in the progression group. Multivariate regression analysis showed HL to be the most important determinant of changes in coronary atherosclerotic lesions. I.S.

A89-14998

SPATIAL WAVEFORM DISCRIMINATION FOLLOWING HIGHER-HARMONIC ADAPTATION

MARK W. GREENLEE and SVEIN MAGNUSSEN (Neurologische Universitaetsklinik, Freiburg im Breisgau, Federal Republic of Germany) Optical Society of America, Journal, A: Optics and Image Science (ISSN 0740-3232), vol. 5, Oct. 1988, p.

1744-1748. refs

(Contract DFG-SFB-325/B4)

It is shown that adaptation to third- and fifth-harmonic frequencies of a square-wave grating does not cause the elevation in threshold for the sine-wave-square-wave discrimination task that was anticipated on the basis of the threshold elevation at the square wave's harmonic frequencies. Hence, a simple linear filtering approach to spatial waveform discrimination cannot explain the human observer's ability to discriminate sine-wave from square-wave gratings after selective suppression of sensitivity at harmonic frequencies. The existence of complex interconnections between neural mechanisms responding to local features (edges) of the retinal image is revealed. K.K.

A89-16576

THERMAL STATE OF THE ORGANISM AND THE WORK CAPACITY OF OPERATORS UNDER THE CONDITIONS OF A HIGH-TEMPERATURE ENVIRONMENT [TEPLOVOE SOSTOIANIE ORGANIZMA I RABOTOSPOSOBNOST' OPERATOROV V USLOVIYAKH VYSOKIKH TEMPERATUR OKRUZHAUSHCHEI SREDY]

A. N. AZHAEV, V. I. ZORILE, and A. N. KOL'TSOV
Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Aug. 1988, p. 50-52. In Russian. refs

The effects of heat on the psychophysiological indexes and the work capacity of humans were investigated by monitoring body temperature, maximal muscle strength, heart rate, and sensomotor reactions in men remaining in a constant-temperature chamber at 25, 30, 35, 40, 45, or 50 C for periods of up to 5 h. It was found that elevated temperature affected the subject's psychophysiological functions as well as the quality of task performance; the character and the degree of change depended on the temperature and the time of exposure. The time of simple sensomotor reaction to sound and the maximal muscle strength were found to change significantly at 45 and 50 C, while the quality of sensomotor control started to decline at 35 C. I.S.

A89-16629

A BIORHYTHMIC CRITERION FOR ESTIMATING THE FUNCTIONAL STATE OF AN OPERATOR [BIORITMICHESKII KRITERII OTSENKI SOSTOIANII OPERATORA]

A. N. NIKITIN (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 74, 1987, p. 94-98. In Russian. refs

This paper discusses the value of using biological rhythms in the psychic activity of a computer operator as a criterion for estimating the functional state of the operator. The mathematical model presented describes the functional state of the operator in terms of background psychic activity, normal activity, elevated activity, monotony, fatigue, and exhaustion. Each of these elements can either be correlated with individual characteristics of different operators or with the states of a given operator performing different types of activity. I.S.

A89-16644

ESTIMATING THE RESISTANCE OF THE HUMAN ORGANISM TO PHYSICAL AND THERMAL LOADS AND ITS THERMAL ADAPTABILITY [OTSENKA USTOICHIVOSTI ORGANIZMA CHELOVEKA K FIZICHESKOI I TEPLOVOI NAGRUZKAM I EGO TERMOADAPTIVNOSTI]

O. S. GORETSKII, V. A. MAKSIMOVICH, and V. A. MAL'TSEV (Nauchno-Issledovatel'skii Institut Gigieny Truda i Profzabolevanii, Donetsk, Ukrainian SSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 14, Sept.-Oct. 1988, p. 823-826. In Russian. refs

This paper describes the criteria and the methods developed for estimating the physiological stability and thermal adaptability of humans on the basis of correlations between the indexes of the organism's functional state and its reactivity to high temperatures and humidity. The functional state of subjects performing physical work in a high-temperature chamber (40 C and 85-90 percent humidity) was estimated from an analysis of changes observed in the functions of cardiovascular, nervous, and respiratory systems and of the water and salt metabolism; the

indexes of thermostability and thermoadaptability were calculated using appropriate equations. It was found that subjects with low values of the thermostability index (most northerners) but high values of thermoadaptability are able to adapt to work in a high-temperature climate. Subjects with low levels of the thermoadaptability index are not likely to adapt to life at high temperatures; it is recommended that these subjects should not change climate. I.S.

A89-16645

FATIGUE PROBLEMS OF FLIGHT PERSONNEL (CONCEPTS, CAUSES, SYMPTOMS, CLASSIFICATION) [PROBLEMY UTOMLENIIA LETNOGO SOSTAVA /PONIATIIA, PRICHINY, PRIZNAKI, KLASSIFIKATSIYA/]

V. A. BODROV Fiziologiya Cheloveka (ISSN 0131-1646), vol. 14, Sept.-Oct. 1988, p. 835-843. In Russian. refs

The concepts defining fatigue and overfatigue in flight personnel are discussed together with the causes of these phenomena and their symptoms. It is noted that, at present, there is no single system for defining symptoms of overfatigue and for its diagnosis. This is due to the fact that the effects of various factors causing overfatigue are accompanied by many nonspecific symptoms which can characterize one or more other functional conditions; in addition, the fatigue phenomenon induces reactions of compensation and adaptation, which may be manifested as both a slow-down and an activation. Complex factors that have to be considered in the evaluation of the fatigue syndrome in pilots are discussed. I.S.

A89-16646

THE EFFECT OF EMOTIONAL STRESS ON THE THROMBOCYTE AGGREGATION AND THE CONTENTS OF ZINC, COPPER, MANGANESE, CALCIUM, AND MAGNESIUM IN PLASMA, ERYTHROCYTES, AND HAIR OF HEALTHY INDIVIDUALS WITH DIFFERENT TYPES OF BEHAVIOR [VLIYANIE EMOTSIONAL'NOGO STRESSA NA AGREGATSIU TROMBOTSITOV, SODERZHANIE TSINKA, MEDI, MARGANTSIA, KAL'TSIYA I MAGNIIA V PLAZME, ERITROTSITAKH I VOLOSAX ZDOROPVYKH LITS S RAZLICHNYMI TIPAMI POVEDENIIA]

P. S. GRIBASKAS, M. IU. KUSHLEIKAITIS, and A. A. GOSHTAUTAS (Nauchno-Issledovatel'skii Institut Fiziologii i Patologii Serdechno-Sosudistoi Sistemy, Kaunas, Lithuanian SSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 14, Sept.-Oct. 1988, p. 857-862. In Russian. refs

A89-16647

SERUM MYOGLOBIN IN HUMAN BLOOD UNDER EXTREME CONDITIONS [MIOGLOBIN SYVOROTKI KROVI CHELOVEKA V EKSTREMAL'NYKH USLOVIYAKH]

A. L. CHERNIAEV and N. F. MURATOV (AMN SSSR, Nauchno-Issledovatel'skii Institut Morfologii Cheloveka, Moscow, USSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 14, Sept.-Oct. 1988, p. 871-873. In Russian. refs

The effect of chronic exposure to a cold climate on blood myoglobin was investigated by comparing the contents of serum myoglobin in residents of Moscow with those living in the extreme north (the city of Magadan). It was found that myoglobin concentrations in sera of the residents of Magadan were significantly higher than in the Moscow residents, especially during the first 10 years of residence in the north. This increase in the northerners was connected with manifestations of the hypoxic syndrome and with an increase in the membrane permeability of cardiac and skeletal muscular myocytes. It is emphasized that this higher-than-normal baseline of serum myoglobin must be allowed for when diagnosing myocardial infarct in northerners. I.S.

A89-16710

THE WEST POINT STUDY - OCCURRENCE OF CORONARY ARTERY DISEASE AFTER 34 YEARS

DALE A. CLARK, WILLIAM G. JACKSON, GIL D. TOLAN, and JAMES R. HICKMAN (USAF, School of Aerospace Medicine,

Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. 1021-1025. refs

The relationship between serum cholesterol levels and the incidence of coronary-artery disease is investigated, reporting the current status of a statistical study of 1956 graduates of the U.S. Military Academy. The data are summarized in graphs and discussed in detail. Although subjects in higher-risk groups (as predicted by the Framingham risk equation) had significantly higher incidence of disease than those in lower-risk groups, the overall incidence was only about half of that seen in analogous civilian groups. Possible reasons for this difference are considered. T.K.

A89-16712* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

CHOLESTEROL IN SERUM LIPOPROTEIN FRACTIONS AFTER SPACEFLIGHT

CAROLYN S. LEACH, PHILIP C. JOHNSON, JR., JANE M. KRAUHS, and NITZA M. CINTRON (NASA, Johnson Space Center; Krug International Corp., Houston, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. 1034-1037. refs

Results are reported from blood-lipid measurements obtained from 125 Space Shuttle crew members before and after space flight. The data are presented in tables and discussed in detail. The main differences noted between preflight and postflight values are a 12.8-percent decrease in high-density lipoproteins on postflight day 1 and significant decreases in total cholesterol and both high- and low-density lipoproteins later in the 23-day postflight period. T.K.

A89-16713* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

VITAMIN D METABOLITES AND BIOACTIVE PARATHYROID HORMONE LEVELS DURING SPACELAB 2

EMILY R. MOREY-HOLTON (NASA, Ames Research Center, Moffett Field, CA), HEINRICH K. SCHNOES, HECTOR F. DELUCA, MARY E. PHELPS (Wisconsin, University, Madison), ROBERT F. KLEIN (California, University, San Francisco) et al. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. 1038-1041. refs

The effect of an 8-day space flight (Spacelab mission 2) on plasma levels of the vitamin D and parathyroid hormones is investigated experimentally in four crew members. The results are presented in tables and graphs and briefly characterized. Parathyroid hormone levels remained normal throughout the flight, whereas vitamin D hormone levels increased significantly on day 1 but returned to normal by day 7. T.K.

A89-16714

CIRCULATING LACTATE AND FFA DURING EXERCISE - EFFECT OF REDUCTION IN PLASMA VOLUME FOLLOWING EXPOSURE TO SIMULATED MICROGRAVITY

DONNA A. WILLIAMS (Pennsylvania State University, University Park) and VICTOR A. CONVERTINO (Bionetics Corp., Cocoa Beach, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. 1042-1046. refs

The relationship between plasma-volume decreases induced by simulated microgravity (10 days of 6-deg-head-down bed rest) and the response of blood lactate and free fatty acid (FFA) levels to exercise is investigated experimentally in 10 healthy male subjects aged 35-49 years. The results are presented in tables and discussed in detail. The 17-percent reduction in plasma volume after bed rest is found to significantly affect the lactate and FFA concentrations during exercise (with the result that lactate concentration is increased but total circulating lactate remains normal, whereas total circulating FFA is decreased). T.K.

A89-16715* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE HEMODYNAMIC EFFECTS OF REPEATED BED REST EXPOSURE

HAROLD SANDLER (NASA, Ames Research Center, Moffett Field,

CA), RICHARD L. POPP, and DONALD C. HARRISON (Stanford University, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. 1047-1054. refs

The effects of three 2-week periods of bed rest (with and without isometric/aerobic exercise, and separated by 3-week ambulatory recovery periods) on hemodynamic responses to stepwise application of LBNP (-20 to -40 mm Hg) are investigated experimentally in seven physically active male subjects aged 19-21 years. The data are presented in extensive tables and graphs and characterized in detail. It is found that bed rest produces significant changes in the responses of heart rate and end-diastolic volume index which (1) are greater than can be accounted for by lowered plasma volume, (2) persist during the recovery periods, and (3) do not respond to the exercises employed to prevent deconditioning. T.K.

A89-16716

THE INFLUENCE OF ACTIVE VERSUS PASSIVE HEAD OSCILLATION, AND MENTAL SET ON THE HUMAN VESTIBULO-OCULAR REFLEX

R. M. JELL, C. W. STOCKWELL, G. T. TURNIPSEED, and F. E. GUEDRY, JR. (U.S. Navy, Naval Aerospace Medical Research Laboratory, Pensacola, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. 1061-1065. Navy-supported research. refs

The effectiveness of mental efforts to control the vestibulo-optical reflex (VOR) was investigated experimentally in eight healthy male subjects as (1) the subject chair was oscillated manually from side to side over a 40-deg arc at 0.1-1 Hz or (2) the subject moved his head from side to side at 0.1-4.0 Hz. The test results are presented in a table and graph and discussed in detail. For head-fixed targets, VOR gain was found to be near zero with oscillation (1) or (2); for earth-fixed targets VOR gain was less than 1 with (1) and about 1 with (2); and for imagined earth-fixed targets in the dark VOR gain was reduced in both (1) and (2), but more so in (1). A frequency dependence of VOR gain was observed for an imagined head-fixed target in the dark. T.K.

A89-16717

STATE-OF-THE-ART MANAGEMENT OF RENAL STONE DISEASE IN AVIATORS AND MILITARY SPECIAL DUTY PERSONNEL

DONALD F. LYNCH (Danville Urologic Clinic, VA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. 1066-1069. refs

New developments in the management and evaluation of military aviators, divers, submariners, or other special-duty personnel with renal stone disease have simplified surgical management of this difficult problem and markedly reduced recuperation time. Aggressive treatment with newly developed modalities (such as ureteroscopy and extracorporeal shock-wave lithotripsy) and careful metabolic evaluation and medical management will often allow the return to full duty of these valuable individuals and allow many who would previously have been permanently disqualified to continue in special duty status. Author

A89-16718

A RETROSPECTIVE ANALYSIS OF AIR-EVACUATED HYPOTHERMIA PATIENTS

JOLENE B. FOX, FRANK THOMAS, TERRY P. CLEMMER, and MICHAEL GROSSMAN (LDS Hospital; Utah, University, Salt Lake City) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. 1070-1075. refs

The outcomes of 17 hypothermia victims evacuated by a civilian helicopter transport service are analyzed statistically. Data on the degree of exposure to hypothermia, the clinical parameters at admission to the hospital, the treatment methods, and the outcomes of helicopter transport were observed, and the rewarming methods applied are found to be effective in all cases. The disabilities encountered (as well as the single fatality) were unrelated to hypothermia. T.K.

A89-16719

A CASE OF HIGH ALTITUDE PULMONARY EDEMA FOLLOWED BY BRAIN COMPUTERIZED TOMOGRAPHY AND ELECTROENCEPHALOGRAPH

MASAO FUKUSHIMA, TOSHIO KOBAYASHI, KEISHI KUBO, KAZUHIKO YOSHIMURA, and TOSHISHIGE SHIBAMOTO (Shinshu University, Matsumoto, Japan) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. 1076-1079. refs

The use of computer tomography and EEG to monitor patients with high-altitude pulmonary and cerebral edema is demonstrated in a case study. The clinical parameters of a 22-year-old male patient are compiled in an extensive table, and sample brain tomograms are shown. Although the patient recovered fully from these disorders, a tomogram obtained 6 years later revealed some brain atrophy, and he did experience some psychological problems after release from the hospital. T.K.

A89-16720

DECOMPRESSION SICKNESS AND THE ROLE OF EXERCISE DURING DECOMPRESSION

K. V. KUMAR (Institute of Aviation Medicine, Bangalore, India) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. 1080-1082. refs

The effect of exercise on the development of altitude decompression sickness (DCS) is examined in a case study of accidental decompression involving a 32-year-old male patient performing treadmill exercise and breathing ambient air in a hypobaric chamber at simulated altitude 4572 m. A sudden descent to 1829 m was followed by a return to 4572 m over 1.5 min while exercise was continued; after 3 min, a gradual descent to ground level was performed (total time at altitude was 80 min), and the first symptoms of DCS appeared about 10 min later. Conservative treatment was applied and led to complete recovery. It is concluded that moderate exercise can predispose healthy subjects breathing ambient air to DCS even at relatively low altitudes. T.K.

A89-16721

NEUROPSYCHIATRIC OBSERVATIONS OF PROPRIOCEPTIVE SENSITIVITY IN MOTION SICKNESS SUSCEPTIBILITY

HUGO O. LEIMANN PATT, ROBERTO L. BAISTROCCHI, and PATRICIA I. MOIA (National Institute of Aviation and Space Medicine, Buenos Aires, Argentina) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. 1083-1088. refs

The development of motion sickness (MS) on cross-coupled acceleration in a Barany chair at 15 rpm is investigated experimentally in 35 normal subjects, 16 patients with 'idiopathic MS', and four pilots with airsickness. The results are presented in extensive tables and graphs and characterized in detail. The MS patients and pilots exhibited significantly increased MS susceptibility as well as straightened cervical curvature; the latter response to the motion is attributed to the obsessive and alexithymic personalities found in these patients in psychological tests. It could lead to increased MS susceptibility by altering proprioceptive inputs to the vestibular nuclei. T.K.

A89-16722

SPONTANEOUS PNEUMOTHORAX - AN ANALYSIS OF PLEURECTOMY VS. CONSERVATIVE THERAPY IN UNITED STATES AIR FORCE FLIERS

W. DOUGLAS EVERETT (USAF, Regional Hospital; Creighton University, Omaha, NE) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. 1089-1093. refs

Using the technique of decision analysis, epidemiological information on spontaneous pneumothorax (SP) in aircrew personnel is analyzed so that consequences of conservative vs operative management can be appreciated. Data do not support a dogmatic approach to SP. Flight surgeons will need to continue to make their recommendations on aeromedical disposition considering the patient, flight duties, and operational environment. Author

A89-16723* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

ANALYSIS OF SLEEP ON SHUTTLE MISSIONS

PATRICIA A. SANTY, HEIDI KAPANKA, JEFFREY R. DAVIS, and DONALD F. STEWART (NASA, Johnson Space Center, Houston, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. 1094-1097. refs

The sleep patterns of 58 Space Shuttle crew members are analyzed statistically on the basis of debriefing forms filled out within 3 days postflight. The data are compiled in a table, and photographs of typical sleep conditions on the Shuttle are provided. It is found that sleep disruption is relatively common on Shuttle missions, especially on the first and last days. Sleep medication was used by 19.4 percent of crew on single-shift flights and 50 percent of crew on dual-shift flights. T.K.

A89-16724

A SYSTEM TO MEASURE LOWER BODY VOLUME CHANGES DURING RAPID ONSET HIGH-G ACCELERATION

L. D. MONTGOMERY (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH), H. M. HANISH (UFI, Inc., Morro Bay, CA), and J. W. BURNS (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. 1098-1102. refs

(Contract F33615-85-C-4505)

A specialized four-channel impedance plethysmograph is described that can be used to measure calf, thigh, and abdominal volume changes during rapid-onset-rate centrifuge acceleration. Typical results are presented to demonstrate its application to research and the design and assessment of countermeasures to enhance man's performance in the high-G environment. Author

A89-16725

DETERMINATION OF THE 'TIME OF USEFUL CONSCIOUSNESS' (TUC) IN REPEATED EXPOSURES TO SIMULATED ALTITUDE OF 25,000 FT (7620 M)

S. IZRAELI, M. GLIKSON, Y. GLOVINSKY (Israeli Defence Forces, Medical Corps, Israel), I. SHOCHAT, D. AVGAR (Israeli Defence Forces, Aeromedical Centre, Ramat Gan, Israel) et al. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. 1103-1105. refs

The performance of 17 healthy subjects aged 18-20 years on tests designed to determine TUC is evaluated during each of two exposures to simulated altitude 7620 m. The test results are presented in a table and graph and briefly characterized. The median TUC values were found to be 267.5 sec at the first exposure and 240 sec at the second. T.K.

A89-16734

RELATIONSHIP BETWEEN PROSTAGLANDIN SYNTHESIS AND RELEASE OF ACIDIC AMINO ACID NEUROTRANSMITTERS

DAVID M. TERRIAN, MICHAEL A. REA, and ROBERT V. DORMAN (USAF, School of Aerospace Medicine, Brooks AFB, TX; Kent State University, OH) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. A2-A9. refs

(Contract AF TASK 2312W3; AF-AFOSR-86-0045)

The presynaptic mechanisms which mediate the release of acidic amino acid neurotransmitters from a nerve terminus were investigated by monitoring the release of D-(H-3)aspartate from a vital preparation of rat cerebellar glomeruli labeled with D-(H-3)Asp and exposed to various test compounds, including K(+) in calcium-containing and calcium-free buffers, 2.7 mM CaCl₂, veratrine, and veratrine + tetrodotoxin. At the same time, the effects of K(+) and Ca(2+) on the incorporation and release of unesterified arachidonic acid in glomerular membranes were measured using (H-3)-arachidonate. The findings indicated that Ca(2+) acts not only to stimulate the release of D(H-3)Asp from a vesicular compartment but also to liberate arachidonic acid from synaptic membrane lipids and provided evidence that the Ca(2+)-dependent accumulation of unesterified arachidonic acid

is required for the release of acidic amino acid neurotransmitters from cerebellar mossy-fiber terminals. I.S.

A89-16735

HIGH-G STRESS AND ORIENTATIONAL STRESS - PHYSIOLOGIC EFFECTS OF AERIAL MANEUVERING

KENT K. GILLINGHAM (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. A10-A20. refs

The causes of G-induced loss of consciousness (GLC) are discussed together with the mechanical, physiological, and educational means of raising G tolerance. Mechanical means include: anti-G suits and valves, assisted positive-pressure breathing systems, and special seats. Physiological means include: frequent exposure to G stress, physical conditioning, selecting pilots that have high natural tolerance, and the practice of performing vigorous and efficient anti-G maneuver. It is pointed out that, while the number of GLC aircraft mishaps each year appears to be dropping, the other serious problem caused by high maneuverability of modern aircraft, namely spatial disorientation, remains essentially unabated and needs to be specifically addressed. I.S.

A89-16736

MECHANISMS OF BIOLOGICAL EFFECTS OF RADIOFREQUENCY ELECTROMAGNETIC FIELDS - AN OVERVIEW

DAVID N. ERWIN (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. A21-A31. USAF-supported research. refs

Bioeffects caused by the absorption of RF radiation (RFR) are discussed, with special attention given to RFR interaction at both low and 'thermal' levels. An overview is presented on data that demonstrate the fertility effects of RFR, the microwave hearing effect, and genetic effects, and the possible mechanisms of the RFR bioeffects are examined. Special consideration is given to the dose of effective RFR. It is emphasized that there is a preponderance of evidence that the RFR effects occur only above the 4 W/kg level. I.S.

A89-16742

TOXICITY ASSESSMENT OF HYDRAZINE FUELS

WILLIAM C. KELLER (USAF, Occupational and Environmental Health Laboratory, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. A100-A106. refs

Major health problems connected with the exposure to hydrazine propellants are discussed, with emphasis on recent literature reports and USAF studies. Animal studies showed that hydrazine is oncogenic, while in vitro studies indicated that it is genotoxic. Embryotoxicity was demonstrated at high exposures, below those of occupationally encountered levels, for both hydrazine and unsymmetrical dimethylhydrazine. The results of animal and in vitro studies resulted in lowering both the time-weighted average-threshold limit values and short-term exposure limits for these propellants. I.S.

A89-16743

TO PREDICT THE BODY'S STRENGTH

HENNING E. VON GIERKE (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. A107-A115. refs

Recent advances made in the theoretical foundations and in methods and tools of biodynamics are discussed together with their contributions to aerospace safety and applications to the areas of traffic safety, orthopedic biodynamics, medicine, and ergonomics. Special attention is given to the mechanical properties of various tissues of the body and its various components and to the meaning of the 'Dynamical Response Index' (DRI) developed for the prediction of the severity of operational injury due to high impact, acceleration, or vibration. An example is presented of the

application of the DRI to predict the probability of spinal injury from seat ejection. I.S.

A89-16744

VISUAL PERCEPTION IN HIGH-SPEED LOW-ALTITUDE FLIGHT

RIK WARREN (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. A116-A124. refs

This paper discusses the objectives, strategies, and issues involved in a comprehensive research program on visual perception and control in high-speed low-altitude flight, conducted at the Armstrong Aerospace Medical Research Laboratory. Several experiments carried out to determine the possibility of flying a simulator at low altitudes in the presence of strong gusts and the value of various types of simple scenes and their combinations for altitude control are reviewed. I.S.

A89-16745

TOXICOKINETICS - AN ANALYTICAL TOOL FOR ASSESSING CHEMICAL HAZARDS TO MAN

HARVEY J. CLEWELL, III, MELVIN E. ANDERSEN, MICHAEL G. MACNAUGHTON, and BRUCE O. STUART (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. A125-A131. refs

This paper discusses the principles of toxicokinetics, an approach developed for predicting the time-dependent uptake, distribution, metabolism, and excretion of potentially toxic chemicals and their metabolites on the basis of biochemical, physiological, and physicochemical properties of a given animal-chemical system. The application of toxicokinetic analysis in a study of chemical hazards control is demonstrated. Physiological models for carbon tetrachloride and methylene chloride are discussed together with the application of these models to estimating the risk of the two chemicals to exposed humans. I.S.

N89-12171# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Aerospace Medical Panel.

MOTION CUES IN FLIGHT SIMULATION AND SIMULATOR INDUCED SICKNESS

Jun. 1988 196 p In ENGLISH and FRENCH Symposium held in Brussels, Belgium, 29 Sep. - 1 Oct. 1987 (AGARD-CP-433; ISBN-92-835-0466-6) Avail: NTIS HC A09/MF A01

These proceedings include seventeen papers, ensuing discussions of the papers, and a Round Table Discussion from the Symposium sponsored by the AGARD Aerospace Medical Panel held in Brussels, Belgium. The frequency of reports of undesirable effects associated with simulator training has increased as simulator usage has increased to offset the higher costs and risks of conducting training in the complex modern aircraft. Review of current and anticipated future trends in simulator design features suggests that additional problems will arise if research on the etiology of simulator-induced motion sickness and other unwanted simulator effects is insufficient to counteract problems before they arise. The objective of this symposium was to examine simulator-induced effects, their operational implications, and their etiology in order to develop ideas for reducing undesired effects.

N89-12172# Essex Corp., Orlando, Fla.

ETIOLOGICAL SIGNIFICANCE OF EQUIPMENT FEATURES AND PILOT HISTORY IN SIMULATOR SICKNESS

R. S. KENNEDY, K. S. BERBAUM, G. O. ALLGOOD, N. E. LANE, M. G. LILIENTHAL (Naval Training Systems Center, Orlando, Fla.), and D. R. BALTZLEY In AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness 22 p Jun. 1988 Avail: NTIS HC A09/MF A01

The U.S. Navy has conducted a survey in 10 flight trainers where motion experience questionnaires and performance tests were administered to pilots before and after 1200 separate

exposures. From these measures on pilots, several findings emerged: (1) specific histories of motion sickness were predictive of simulator sickness symptomatology; (2) postural equilibrium was degraded after hops in some simulators; (3) self-reports of motion sickness symptomatology revealed three major symptom clusters; gastrointestinal, visual, and vestibular; (4) certain pilot experiences in simulators and aircraft were related to severity of symptoms experienced; (5) simulator sickness incidences varied from 10 to 60 percent; (6) substantial perceptual adaptation occurs over a series of hops; (7) in two moving-base flight trainers motion sickness incidence appeared to be related to the amount of acceleration (energy) experienced in frequency ranges around 0.2 Hz. The findings are discussed in the context of sensory conflict theory and recommendations are made for simulator design criteria. Suggestions are made as to how to relate simulator and equipment configuration to the separate symptom clusters as an aid to the diagnosis of specific problems within particular simulators. It is believed that this holds promise in diagnosing simulator equipment problems (e.g., alignment, inertial motion profile, cue asynchrony) since different symptom clusters may be related to different equipment features. Author

N89-12173# National Aerospace Lab., Amsterdam (Netherlands).

TECHNOLOGY INVOLVED IN THE SIMULATION OF MOTION CUES: THE CURRENT TREND

H. A. MOOIJ /in AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness 15 p Jun. 1988
 Avail: NTIS HC A09/MF A01

The subject of motion cue generation is a topic that requires serious attention from all involved in the design, development and manufacture of flight simulators. The enhanced realism in the depiction of terrain, sky, and other aircraft available in current visual systems has been associated with an increasing number of instances of simulator sickness. This form of sickness is the constellation of symptoms which may be experienced by pilots as a result of flying a simulator. As one of the introductory papers of the AGARD Aerospace Medical Symposium on Motion cues in flight simulation and simulator induced sickness this paper presents observations concerning the current trend in visual and motion systems. After an introduction of basic cuing methodology in flight simulation, the overview concentrates on developments in image generation, image display, platform motion cue generation and motion hardware mechanisms. The paper concludes with some observations concerning the importance of maintenance and calibration of flight simulator installations. Author

N89-12174# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).

AETIOLOGICAL FACTORS IN SIMULATOR SICKNESS

A. J. BENSON /in AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness 8 p Jun. 1988
 Avail: NTIS HC A09/MF A01

The clinical features of simulator sickness are similar to the malaise induced by other motion stimuli. The essential etiology of the condition is considered to be the same as in other types of motion sickness, namely, the mismatch between the motion information provided by the body's sense organs and the brain's internal model of expected motion cues. The mismatch can be between concomitant inputs provided by the angular and linear acceleration transducers of the vestibular apparatus, or between visual and vestibular inputs. More significantly, in a fixed base simulator it is the absence of expected inertial cues when the ambient visual system is stimulated by the external world, visual display that engenders neural mismatch. Even when the simulator has a motion base, quantitative and temporal disparities between visual and inertial cues commonly occur and can contribute, along with visual distortions and other anomalies, to the induction of the motion sickness syndrome. Author

N89-12175# Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge (France). Centre d'Essais en Vol.

HORIZONTAL STUDY OF THE INCIDENCE OF SIMULATOR INDUCED SICKNESS AMONG FRENCH AIR FORCE PILOTS [ETUDE HORIZONTALE DE L'INCIDENCE DU MAL DES SIMULATEURS DANS LES FORCES AERIENNES FRANCAISES]

A. LEGER, P. SANDOR, and R. P. DELAHAYE (Service de Sante pour l'Armee de l'Air, Paris, France) /in AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness 7 p Jun. 1988 In FRENCH; ENGLISH summary
 Avail: NTIS HC A09/MF A01

Reports of simulator sickness obtained from pilots in the Air Force of France are summarized. Of 164 pilots responding, 153 responses were judged suitable for general descriptive analysis, and 132 were retained for detailed analysis. In contrast to other studies in which on-site investigators evaluated effects induced by specific simulators, questionnaires were used to obtain information on the past simulator experience of pilots (and motion sickness in general) from different units of the French Air Force. Thus, the results are based on questionnaires answered anonymously relating to past experience in different simulators over a number of years. Sixty-seven percent of those responding had experienced simulator-induced sickness to some degree, but the majority of effects elicited were moderate and decreased rapidly after several sessions. Aftereffects were absent in 51 percent, insignificant in 34.8 percent, moderate in 9.8 percent, and severe in 3.8 percent of the responding subjects. In contrast with an earlier study, statistically significant relationship between simulator sickness and motion sickness in general (indicated by scores from a motion sickness questionnaire) was not found. Author

N89-12176# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

SIMULATOR INDUCED SICKNESS AMONG HERCULES AIRCREW

L. E. MAGEE, L. KANTOR, and D. M. C. SWEENEY /in AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness 8 p Jun. 1988
 Avail: NTIS HC A09/MF A01

The purposes of this study were to investigate the incidence, severity and time-course of simulator sickness among pilots and flight engineers training on a C-130H (Hercules) flight simulator, and to assess the influence of flight experience on susceptibility. Evidence of simulator sickness was collected by questionnaire, tests of balance, and observation. The questionnaires were completed at the conclusion of a four-hour training session and 20 hours later. The balance tests were performed immediately prior to and immediately following the training session. Overt signs of pallor, sweating, drowsiness and visual nystagmus were also recorded at these times. Thirty-five of the 42 aircrew (i.e., 83 percent) tested reported characteristic symptoms of simulator sickness. The most prevalent were eyestrain, mental and physical fatigue, and after-sensations of motion. Some effects persisted following simulator training for many hours although most were not severe. Few had delayed onset. Although eleven subjects (26 percent) reported loss of balance at the end of the training session, performance on the balance tests improved; this suggests a practice effect which masks ataxia. With the exception of occasional nystagmus, no overt signs of simulator sickness were evident. The relationships between aircraft experience, both general and type-specific, and diagnostic scores based on symptoms were examined. There was no evidence to indicate that experience influenced susceptibility to simulator sickness. Author

N89-12177# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).

SIMULATOR SICKNESS IN THE ROYAL AIR FORCE: A SURVEY

J. W. CHAPPELOW /in AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness 11 p Jun. 1988
 Avail: NTIS HC A09/MF A01

A questionnaire survey was undertaken of pilots with experience

of two air combat simulators. Two hundred and seventy one respondents completed questionnaires, some up to two years retrospectively and others immediately after a simulator session. There were, thus, four separate studies. The questionnaires sought information on the incidence of disequilibrium and other symptoms experienced in the simulator and after leaving it. The proportion of those suffering at least one symptom in the simulator varied between 50 percent and more than 90 percent across studies (53.5 percent overall). However, not all the symptoms reported were unequivocally ascribable to disequilibrium. The proportion of each sample reporting delayed symptoms was between 10 percent and 50 percent (13 percent overall). The effect on the respondents' motivation to use the simulator was negligible. Author

N89-12178# Army Aeromedical Research Lab., Fort Rucker, AL.

SIMULATOR SICKNESS IN US ARMY AND NAVY FIXED- AND ROTARY-WING FLIGHT SIMULATORS

DANIEL W. GOWER, JR., MICHAEL G. LILIENTHAL, ROBERT S. KENNEDY, and JENNIFER E. FOWLKES (Essex Corp., Orlando, Fla.) /n AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness 20 p Jun. 1988
 Avail: NTIS HC A09/MF A01

As technology has been developed to provide improved visual and motion systems in operational flight trainers and weapons tactics trainers, there have been increasing reports of the occurrence of simulator sickness. Simulator sickness here refers to one or more symptoms which can occur while in a simulator, immediately after exposure, or at some later time. Flight instructors have complained these symptoms interfere with simulator usage. More critical is the potential for in-flight problems due to prolonged physiological effects. As a result, flight activities after simulator flight have been limited in some commands. The U.S. Army Aeromedical Research Laboratory at Fort Rucker, Alabama, and the Naval Training Systems Center at Orlando, Florida, conducted field surveys to document the extent of the simulator sickness problems at operational fixed and rotary-wing simulator sites. Data are pooled from 10 different Navy flight simulators and the Army's AH-64 flight simulator. The total number of surveys is about 1500, with the number of subjects in each simulator type ranging from 18 to 280. The simulator sickness incidence rates and the relative frequency of specific symptoms are presented and correlational factors such as flight experience, simulator experience, and flight mode also are presented. Difficulties in assessing the duration of simulator sickness effects are noted, and attempts made to present the symptom duration for the Army's AH-64 combat mission simulator (CMS). Unique to this CMS is its use of the helmet display unit (HDU) in conjunction with the other visuals in the simulator. Author

N89-12179*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE USE OF VESTIBULAR MODELS FOR DESIGN AND EVALUATION OF FLIGHT SIMULATOR MOTION

STEVEN R. BUSSOLARI, LAURENCE R. YOUNG (Massachusetts Inst. of Tech., Cambridge.), and ALFRED T. LEE /n AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness 11 p Jun. 1988

(Contract NAG2-12)

Avail: NTIS HC A09/MF A01

Quantitative models for the dynamics of the human vestibular system are applied to the design and evaluation of flight simulator platform motion. An optimal simulator motion control algorithm is generated to minimize the vector difference between perceived spatial orientation estimated in flight and in simulation. The motion controller has been implemented on the Vertical Motion Simulator at NASA Ames Research Center and evaluated experimentally through measurement of pilot performance and subjective rating during VTOL aircraft simulation. In general, pilot performance in a longitudinal tracking task (formation flight) did not appear to be sensitive to variations in platform motion condition as long as motion was present. However, pilot assessment of motion fidelity by means of a rating scale designed for this purpose, were sensitive

to motion controller design. Platform motion generated with the optimal motion controller was found to be generally equivalent to that generated by conventional linear crossfeed washout. The vestibular models are used to evaluate the motion fidelity of transport category aircraft (Boeing 727) simulation in a pilot performance and simulator acceptability study at the Man-Vehicle Systems Research Facility at NASA Ames Research Center. Eighteen airline pilots, currently flying B-727, were given a series of flight scenarios in the simulator under various conditions of simulator motion. The scenarios were chosen to reflect the flight maneuvers that these pilots might expect to be given during a routine pilot proficiency check. Pilot performance and subjective rating of simulator fidelity was relatively insensitive to the motion condition, despite large differences in the amplitude of motion provided. This lack of sensitivity may be explained by means of the vestibular models, which predict little difference in the modeled motion sensations of the pilots when different motion conditions are imposed. Author

N89-12180# German Army Hospital, Ulm (West Germany). Abt. Neurologie und Psychiatrie.

MOTION CUES IN EVERY DAY LIFE

J. KRIEBEL, A. KORNHUBER, and M. LANG (Ulm Univ., West Germany) /n AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness 8 p Jun. 1988
 Avail: NTIS HC A09/MF A01

Motion cues are perceived via different sensory modalities. Convergence of teleceptive and proprioceptive sensory information is a prerequisite of task-related sensible motor reaction. Research with event-related brain potentials (ERP) delivers important functional and topographical information of these complex interactions. From ERP data the function of the frontomesial supplementary motor area (SMA) could be analyzed. Their important role in timing sequential tasks and connecting the sensory and motor system is demonstrated. Sensory dysfunctions might irritate the onset and sequence of task related motor reactions. Vestibular evoked cerebral potentials are chosen to demonstrate the restrictions of the interpretation of the ERP results. From steady state evoked and transient evoked potentials further knowledge can be expected. Author

N89-12181# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Industrial Engineering and Operations Research.

MANIFESTATION OF VISUAL/VESTIBULAR DISRUPTION IN SIMULATORS: SEVERITY AND EMPIRICAL MEASUREMENT OF SYMPTOMATOLOGY

JOHN G. CASALI and LAWRENCE H. FRANK (Pacific Missile Test Center, Point Mugu, Calif.) /n AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness 18 p Jun. 1988

Avail: NTIS HC A09/MF A01

Reported incidence rated of vehicular simulator induced sickness in operators is highly variable both within and between devices. Recent literature reviews show that documented incidence rates range from 0 to nearly 90 percent in flight devices and even higher in some driving devices. However, the severity of the simulator sickness problem is not adequately gauged by a simple count of those operators experiencing one or more physiologic symptoms. Instead, a battery of metrics is useful in identifying and properly assessing an induced state of simulator sickness. This is of particular importance with the recent thrust in empirical research toward determination of the effects of simulator design parameters, such as control loop delays, on operator sickness and performance. This paper reviews the symptomatology experienced by operators of flight and driving simulators. Drawing upon this review, dependent measures are recommended for use in simulator-sickness research, including self-report forms, specific physiologic indices, postural equilibrium tests, performance tests, and susceptibility prediction instruments. A tabular documentation of published research studies concerning simulator sickness is also provided. Author

N89-12182# Pacific Missile Test Center, Point Mugu, Calif.
MODELLING OPERATOR CONTROL PERFORMANCE AND WELL-BEING AS A FUNCTION OF SIMULATOR VISUAL AND MOTION SYSTEM TRANSPORT DELAYS

LAWRENCE H. FRANK and JOHN G. CASALI (Virginia Polytechnic Inst. and State Univ., Blacksburg.) /n AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness 7 p Jun. 1988

Avail: NTIS HC A09/MF A01

The role of visual-motion coupling delays and cueing order on operator performance and uneasiness was assessed in driving simulators by means of a response surface methodology central-composite design. The most salient finding of the study was that visual delay appears to be more disruptive to an individual's control performance and well-being than is motion delay. Empirical multiple regression models were derived to predict 10 reliable measures of simulator operator driving performance and comfort. Principal components analysis on these 10 models decomposed the dependent measures into two significant models which were labeled vestibular disruption and degraded performance. Examination of the empirical models revealed that, for asynchronous delay conditions, better performance and well-being were achieved when the visual system led the motion system. A secondary analysis of the role of subject gender and perceptual style on susceptibility to simulator sickness revealed that neither of these independent variables was a significant source of variance. Author

N89-12183# Centre de Medecine Aerospatiale, Brussels (Belgium).

AN INVESTIGATION OF SIMULATOR SICKNESS AND AN ELECTRONYSTAGMOGRAPHIC STUDY [ENQUETE SUR LE MAL DES SIMULATEURS DE VOL COUPLEE A UNE ETUDE NYSTAGMOGRAPHIQUE]

G. DEHEYN, P. DEGRAFF, and P. VANDENBOSCH /n AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness 5 p Jun. 1988 /n FRENCH; ENGLISH summary

Avail: NTIS HC A09/MF A01

Simulator sickness, which is related to travel sickness, is a product of high technology, safety requirements and budgetary limitations. This new pathology affects experienced pilots and is the result of conflicting sensations, experienced in an unfamiliar environment. We conducted a survey of a Belgian Air Force fighter squadron in order to evaluate the frequency of simulator sickness and the symptoms experienced. Ten percent of the pilots questioned regularly experienced simulator sickness and twenty-five percent felt it occasionally in varying degrees. We also attempted to objectify the problems of vertigo and disorientation by means of an electronystagmographic study of 12 pilots during their training on a flight simulator. We were surprised by the poor ocular response during the simulated flight. Nystagmic movements appeared rarely and then only fleetingly, mainly at the end of a turn. They were all low amplitude. We were not able to establish a correlation between the objective vestibular responses and the subjective feelings of simulator sickness. Author

N89-12184*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

HEAD-MOUNTED SPATIAL INSTRUMENTS: SYNTHETIC REALITY OR IMPOSSIBLE DREAM

STEPHEN R. ELLIS, ARTHUR GRUNWALD, and MORDEKHAIELVELGER /n AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness 8 p Jun. 1988

Avail: NTIS HC A09/MF A01

A spatial instrument is defined as a display device which has been either geometrically or symbolically enhanced to better enable a user to accomplish a particular task. Research conducted over the past several years on 3-D spatial instruments has shown that perspective displays, even when viewed from the correct viewpoint, are subject to systematic viewer biases. These biases interfere with correct spatial judgements of the presented pictorial information. It is also found that deliberate, appropriate geometric distortion of the perspective projection of an image can improve

user performance. These two findings raise intriguing questions concerning the design of head-mounted spatial instruments. The design of such instruments may not only require the introduction of compensatory distortions to remove the neutrally occurring biases but also may significantly benefit from the introduction of artificial distortions which enhance performance. These image manipulations, however, can cause a loss of visual-vestibular coordination and induce motion sickness. Additionally, adaptation to these manipulations is apt to be impaired by computational delays in the image display. Consequently, the design of head-mounted spatial instruments will require an understanding of the tolerable limits of visual-vestibular discord. Author

N89-12185# York Univ. (Ontario). Human Performance Lab.
INFLUENCE OF VECTION AXIS AND BODY POSTURE ON VISUALLY-INDUCED SELF-ROTATION AND TILT

I. P. HOWARD, B. CHEUNG, and J. LANDOLT (Defence and Civil Inst. of Environmental Medicine, Downsview, Ontario) /n AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness 8 p Jun. 1988

Avail: NTIS HC A09/MF A01

Yaw vection is induced by a scene rotating about spinal axis (z axis), pitch vection by a scene rotating about an axis in the mid-frontal plane (y axis) and roll vection by a scene rotating about an axis parallel to the line of sight (x axis). Each of these axes can be vertical or horizontal, making six conditions in all, of which only four have been studied previously. We studied vection and illusory body tilt under all six conditions, with a full rotating field, reduced somesthetic cues and in a situation in which body rotation could occur. Yaw vection around a vertical axis was strongest. Forward pitch vection was stronger than backward pitch vection. Contrary to previous reports, for most subjects backward illusory tilt was much stronger than forward illusory tilt. Two subjects experienced 360 deg body rotation in the horizontal-pitch condition. The direction of pitch axis asymmetry was found to be consistent and not related to the asymmetry of vertical optokinetic nystagmus. Author

N89-12186# York Univ. (Ontario). Human Performance Lab.
VECTION AND THE SPATIAL DISPOSITION OF COMPETING MOVING DISPLAYS

I. P. HOWARD, M. OHMI, W. SIMPSON, and J. P. LANDOLT (Defence and Civil Inst. of Environmental Medicine, Downsview, Ontario) /n AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness 8 p Jun. 1988

(Contract DCIEM-97711-4-7936/8SE84-00110)

Avail: NTIS HC A09/MF A01

In Experiment 1 we investigated the relative effectiveness of two superimposed displays in generating circular vection as a function of: (1) the separation in depth between them, (2) their perceived relative distances, and (3) which display was in the plane of focus. Circular vection was found to be governed by the display that was perceived to be more distant, even when it was actually nearer. Vection was not affected by whether the near or far display was in the plane of focus, nor by which display was fixated or pursued by the eyes. In Experiment 2 we asked whether the generally held belief that vection is induced most effectively by the peripheral stimuli is due to an artifactual effect of perceived distance. The experiment assessed the separate contributions of foreground-background and central-peripheral placement of competing displays. It was found that both factors contribute in an interactive way to the experience of vection. In Experiment 3 we investigated how linear forward vection induced by a looming visual display is affected by the near-far relationships of competing displays. Author

N89-12187# University Hospital, Leuven (Belgium). Dept. of Otoneurology and Equilibriometry.

CUES FOR TRAINING VERTIGO, PROVIDING SUGGESTIONS FOR THE MANAGEMENT OF SIMULATOR SICKNESS

MARCEL E. NORRE /n AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness 4 p Jun. 1988

Avail: NTIS HC A09/MF A01

Clinical experience with exercise treatment for vertigo has confirmed the extreme adaptability of the balance system. Vestibular Habituation Training (VHT) for provoked (positioning) vertigo provides some interesting cues in the scope of the theme of this meeting, related to simulator sickness. The disabling sensation, called motion sickness, means only a disturbance similar to vertigo. In both, the sensory observation of the environment by the three sensors results in a sensory mismatch. In vertigo it is one of the sensors that works in a wrong way and in motion sickness it is an unusual presentation of the environment structure that causes the mismatch. Provoked vertigo as well as motion sickness is linked to actual working of the system. In both situations the system has to work up changing relationships: in the provoked vertigo the changing situation has no contradiction in se related to a normal working schedule of the system, whereas it has in motion sickness. In both cases it must be possible to re-organize the effect of the changed sensory input by central adaptation. Clinical experience confirmed it; repeated exposure to the mismatch is the very stimulus and has a positive effect in provoked vertigo. Persons with motion sickness can be habituated in the same way as we observe it for our patients with provoked vertigo: i.e., progressively by exposure and specifically, related to the stimulus pattern of the exposure. Author

N89-12188*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

PREADAPTATION TO THE STIMULUS REARRANGEMENT OF WEIGHTLESSNESS: PRELIMINARY STUDIES AND CONCEPTS FOR TRAINER DESIGNS

D. E. PARKER and M. F. RESCHKE /in AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness 9 p Jun. 1988 Prepared in cooperation with Miami Univ., Oxford, Ohio Avail: NTIS HC A09/MF A01

An effort to develop preflight adaptation training (PAT) apparatus and procedures to adapt astronauts to the stimulus rearrangement of weightless spaceflight is being pursued. Based on the otolith tilt-translation reinterpretation model of sensory adaptation to weightlessness, two prototype preflight adaptation trainers (PAT) have been developed. These trainers couple pitch movement of the subject with translation of the visual surround. Subjects were exposed to this stimulus rearrangement for periods of 30 m. The hypothesis is that exposure to the rearrangement would attenuate vertical eye movements was supported by two experiments using the Miami University Seesaw (MUS) PAT prototype. The Dynamic Environment Simulator (DES) prototype failed to support this hypothesis; this result is attributed to a peculiarity of the DES apparatus. A final experiment demonstrated that changes in vertical eye movements were not a consequence of fixation on an external target during exposure to a control condition. Together these experiments support the view that preflight adaptation training can alter eye movements in a manner consistent with adaptation to weightlessness. Following these initial studies, concepts for development of operational preflight trainers were proposed. The trainers are intended to: demonstrate the stimulus rearrangement of weightlessness; allow astronauts to train in altered sensory environment; modify sensory motor reflexes; and reduce/eliminate space motion sickness symptoms. Author

N89-12189# Oak Ridge National Lab., Tenn. Health and Safety Research Div.

PUBLIC HEALTH RISK FROM ELF (ELECTROMAGNETIC FIELDS) EXPOSURE: CAN IT BE ASSESSED

T. E. ALDRICH and C. E. EASTERLY 1988 4 p Presented at the Meeting of the International Agency for Research on Cancer, Lyon, France, 2 May 1988

(Contract DE-AC05-84OR-21400)

(DE88-015277; CONF-8805176-1) Avail: NTIS HC A02/MF A01

Extremely low frequency electromagnetic fields (ELF) are a ubiquitous environmental agent. There are persistent indications that these fields have biologic activity, and consequently, there may be a deleterious component to their action. Epidemiologic researchers of ELF face several methodological obstacles, and

quantitative risk assessment is in a quandary. Simply stated there is a need for more data, especially with regard to exposure assessment. DOE

N89-12190# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

BIOLOGICAL EFFECTS OF VERY LOW DOSES OF IONIZING RADIATION

V. S. EVSEEV 1987 6 p

(DE88-703372; JINR-E-19-87-465) Avail: NTIS (US Sales Only) HC A02/MF A01

The paper deals with a qualitative microdosimetric analysis of a new radiobiological phenomenon (physiological reaction of the cell as a whole to very low doses of ionizing radiations). The analysis is aimed at identifying the type of the primary interaction of radiation with the cell and finding its place in the cell. DOE

N89-12191# Army Research Inst. of Environmental Medicine, Natick, MA.

HEAT-RELATED ILLNESSES

BARRY E. YARBROUGH and ROGER W. HUBBARD Apr. 1988 86 p

(AD-A197730; USARIEM-M-52/88) Avail: NTIS HC A05/MF A01 CSCL 06E

This chapter in the 2nd edition of the Management of Wilderness and Environmental Emergencies provides background material in the following areas: Physics of heat transfer, physiology of human body temperature regulation, the CNS interface between thermosensors and thermoregulatory effectors, skin blood flow and vasodilation, and acclimatization. The heat illnesses coverage includes information on predisposing factors, thermometry, and fever versus hyperthermia. The review of heat illnesses includes heat cramps, heat edema, heat syncope, heat exhaustion and heat stroke. Treatment coverage includes the differential diagnosis, classical versus exertional forms of heatstroke, the systematic and cellular approach to pathophysiology which includes an organ by organ analysis. The specifics of treatment provides insight to electrolyte abnormalities, acid-base abnormalities and the ABC's of therapy including cooling, modalities, adjunctive measures and prevention. GRA

N89-12192*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A COMPUTER PROGRAM FOR PROCESSING IMPEDANCE CARDIOGRAPHIC DATA: IMPROVING ACCURACY THROUGH USER-INTERACTIVE SOFTWARE

PATRICIA S. COWINGS, KAREN NAIFEH, and CHET THRASHER Oct. 1988 58 p Prepared in cooperation with California Univ., San Francisco

(NASA-TM-101020; A-88260; NAS 1.15:101020) Avail: NTIS HC A04/MF A01 CSCL 06P

This report contains the source code and documentation for a computer program used to process impedance cardiography data. The cardiodynamic measures derived from impedance cardiography are ventricular stroke column, cardiac output, cardiac index and Heather index. The program digitizes data collected from the Minnesota Impedance Cardiograph, Electrocardiography (ECG), and respiratory cycles and then stores these data on hard disk. It computes the cardiodynamic functions using interactive graphics and stores the means and standard deviations of each 15-sec data epoch on floppy disk. This software was designed on a Digital PRO380 microcomputer and used version 2.0 of P/OS, with (minimally) a 4-channel 16-bit analog/digital (A/D) converter. Applications software is written in FORTRAN 77, and uses Digital's Pro-Tool Kit Real Time Interface Library, CORE Graphic Library, and laboratory routines. Source code can be readily modified to accommodate alternative detection, A/D conversion and interactive graphics. The object code utilizing overlays and multitasking has a maximum of 50 Kbytes. Author

N89-12193# Atomic Weapons Research Establishment, Aldermaston (England).

ULTRASONIC RESUSPENSION OF COLLECTED DUST ON FILTER PAPERS FOR PARTICLE SIZE ANALYSIS

J. N. PARSONS May 1988 31 p
(AWE-O-10/88; BR106846; ISBN-0-85-518182-6; ETN-88-93563)
Avail: Her Majesty's Stationary Office, 49 High Holborn, London W.C. 1, United Kingdom, 4 pounds

A method which resuspends and aerodynamically analyzes aerosols, collected on personal air samples (PASs), from which data can be obtained to predict respiratory tract deposition following occupational exposure is described. Three uranium oxide dusts were studied and the effect of PAS collection and subsequent regeneration were measured. Disruption of the size distributions is observed but predictions of deposition in the various respiratory tract regions are sufficiently accurate to assist in assessment of internal radiation dose. Correction factors which further improve the accuracy of the predictions are suggested. ESA

N89-13132# Army Research Inst. of Environmental Medicine, Natick, MA.

DERIVATION OF ANTHROPOMETRY BASED BODY FAT EQUATIONS FOR THE ARMY'S WEIGHT CONTROL PROGRAM Technical Report, Jun. - Nov. 1984

J. A. VOGEL, J. W. KIRKPATRICK, P. I. FITZGERALD, J. A. HODGDON, and E. A. HARMAN May 1988 55 p
(AD-A197371; USARIEM-17-88) Avail: NTIS HC A04/MF A01 CSCL 051

Large inter-observer variability is a major disadvantage to the use of skinfold measurements for the prediction of percent body fat. This is particularly relevant in the Army's weight control program where standardized training is difficult for the large number of required observers located worldwide and who frequently turn over due to reassignment. This necessitated the development of an alternative method that required no formal training, could be administered by non-technical personnel and had low inter-observer variability. This report describes circumference-based equations that were developed to replace the skinfold equations. The equations apply to all ages and racial groups. Conversion tables were developed for easy calculation of percent body fat from the raw measurements of circumferences, height and weight. In those individuals exceeding the weight-height table, the equation was more accurate in males in correctly classifying individuals than the weight-height table but only marginally better in women. In addition to the ease of measurement by non-technical observers, the equations better predict percent body fat measured by hydrostatic weighing than do the previously used Durnin-Womersley skinfold equations when considering all ages, racial groups and degrees of adiposity. GRA

N89-13133# Technology, Inc., San Antonio, Tex. Life Sciences Div.

RESEARCH AND DEVELOPMENT OF ANTI-G LIFE SUPPORT SYSTEMS. PART 2: DECOMPRESSION SICKNESS RESEARCH Final Report, 1 Apr. 1981 - 31 Jul. 1985

ROBERT W. KRUTZ, ROBERT M. OLSON, BIJAN ESHAGHIAN, EMILY M. GAUSE, and WILLIAM T. HARVEY May 1988 28 p
(Contract F33615-81-C-0600)
(AD-A197675; USAFSAM-TR-86-36-PT-2) Avail: NTIS HC A03/MF A01 CSCL 06J

Instrumentation and techniques for differentiating bends-prone and bends-resistant individuals were developed. Studies were conducted to determine bends- and bubble-formation altitudes using a variety of simulated pressure-suit pressures and breathing gas mixtures. A pressure of 9.5 psia eliminated the occurrence of bends under the conditions of these studies. In vitro studies of intravenous bubble formation were undertaken. United States Air Force (U.S.A.F.) aircrews must be prepared to encounter loss of cabin pressure caused by either mechanical failure or deliberate maneuvering of aircraft. Aircrews generally tolerate short-duration depressurization well, but decompression sickness (DCS) occurs much more often than is reported. Symptoms of DCS range in severity from minor to life threatening; however, all incidences of

DCS require medical attention to preclude subsequent problems. The physiological mechanisms involved in DCS are not completely understood, but DCS is considered to result from supersaturation of body tissues with nitrogen (N₂). Supersaturation sets in as the ambient pressure (hence the absolute pressure of N₂) decreases. Nitrogen is less soluble in blood than in tissues so that the rate of decrease of partial pressure of N₂ in tissues lags behind the rate of decrease in atmospheric N₂ pressure, resulting in formation of N₂ bubbles in blood and tissues. The tendency for bubbles to form is greater as the difference between the two pressure increases. GRA

N89-13134# Naval Submarine Medical Center, Groton, Conn.
DISCRIMINATION AND IDENTIFICATION OF MODULATION-FREQUENCY USING NOISE, TONE AND TONAL-COMPLEX CARRIERS

THOMAS E. HANNA 23 May 1988 26 p
(AD-A197780; NSMRL-1117) Avail: NTIS HC A03/MF A01 CSCL 06D

A two-interval, two-alternative, forced-choice discrimination task (2I-2AFC) and an identification task were used to measure listeners' abilities to resolve modulation frequency, using three different types of carrier--noise, a 1-kHz tone, or a tonal complex. Identification performance was not simply related to 2I-2AFC discrimination performance. Identification of stimuli near the edges of the range was relatively good compared with listeners' abilities to discriminate these stimuli, a result which has been found for other stimuli (e.g., Berliner, Durlach, and Braida, 1977). In addition, certain midrange stimuli were identified relatively well, indicating the effects of central factors that enhance the encoding of these stimuli. Results for the 1-kHz and the tonal-complex carrier showed enhanced identification of modulation frequencies in the range 50 to 80 Hz. The results for the noise carrier, however, indicated enhanced resolution only for modulation frequencies less than 54 Hz. Possible explanations for these effects are discussed, and it is suggested that a more detailed examination of the role of the stimulus context would provide some answers. GRA

N89-13135# Oak Ridge National Lab., Tenn. Office of Risk Analysis.

HUMAN EXPOSURE TO DIOXIN FROM COMBUSTION SOURCES

HOLLY A. HATTEMER-FREY and CURTIS C. TRAVIS 1988 20 p Presented at the Symposium on Emissions From Combustion Processes, Toronto, Ontario, 5 Jun. 1988
(Contract DE-AC05-84OR-21400)
(DE88-013825; CONF-8806227-1) Avail: NTIS HC A03/MF A01

Because of their extreme toxicity, much concern and debate has arisen about the nature and extent of human exposure to dioxin. Since municipal solid waste (MSW) incinerators are known to emit polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), many people who live near MSW incinerators fear that they will be exposed to high levels of dioxin and subsequently develop cancer. What is often overlooked in this debate, however, is the fact that the general population is continuously being exposed to trace amounts of dioxin as exemplified by the fact that virtually all human adipose tissue samples contain dioxin at levels of 3 parts per trillion (ppt) or greater. This paper provides a perspective on MSW incineration as a source of human exposure to dioxin by comparing this exposure source with exposure to background environmental contamination and evaluates some of the potential key sources of PCDD/PCDF input into the environment. DOE

N89-13136# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Flugmedizin.

GLUCOSE TOLERANCE AND INSULIN SECRETION DURING 0-G SIMULATION Ph.D. Thesis - Technische Hochschule, Aachen

SABINE TRUMBACH Aug. 1987 86 p In GERMAN; ENGLISH summary

(DFVLR-FB-88-25; ISSN-0171-1342; ETN-88-93525) Avail: NTIS HC A05/MF A01; DFVLR VB-PL-DO, 90 60 58, 5000 Cologne, Federal Republic of Germany, 29.50 deutsche marks

To improve the health conditions of astronauts during space missions, 12 male volunteers were examined with regard to glucose and insulin metabolism during 7 days of 0 g simulation (6 deg head down tilt). Before, during, and after simulation oral glucose-tolerance tests were done; glucose, insulin and c-peptide concentration in serum was measured, along with creatinine, osmolality, hematocrit and electrolytes. During the simulation, glucose-tolerance decreases. Parallel to this insulin concentration increases, due to increased secretion, whereas a decreased decomposition of insulin is improbable. Comparing six trained with six less trained volunteers (discovered by spiroergometry) shows no significant differences. ESA

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BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

A89-13230

THE SELF-EVALUATION OF POLAR-EXPEDITION WORKERS AND ITS DYNAMICS DURING THE ANATARTIC WINTER STAY (SAMOOTSENKA POLIARNIKOV I EE DINAMIKA V PERIOD ANTARKTICHESKOI ZIMOVKI)

A. P. BIZIUK Problemy Arktiki i Antarktiki (ISSN 0555-2468), no. 63, 1987, p. 107-113. In Russian. refs

The paper examines results of multiyear studies of the self-evaluation of polar-expedition workers during Antarctic winters in connection with the level of their sociopsychological adaptation. The results point to the good adaptive capabilities of the workers in connection with the subjective sphere. B.J.

A89-15159

LONG-TERM VARIABILITY IN THE SPECTRAL LOCI OF UNIQUE BLUE AND UNIQUE YELLOW

KEVIN LAXAR (U.S. Navy, Naval Submarine Medical Research Laboratory, Groton, CT), DAVID L. MILLER, and B. R. WOOTEN (Brown University, Providence, RI) Optical Society of America, Journal, A: Optics and Image Science (ISSN 0740-3232), vol. 5, Nov. 1988, p. 1983-1985. Navy-supported research. refs

The spectral loci of both unique blue and unique yellow were measured over a 16-month period. Using the method of constant stimuli, two neutrally adapted observers made forced-choice green or red responses to monochromatic test flashes. Results showed a consistent difference between observers (about 5 nm), considerable within-subject variability (standard deviation 3 nm), and significant long-term drifts (greater than 5 nm) in spectral loci. These results demonstrate the importance of frequently redetermining unique-hue loci when they are used as baselines in chromatic contrast and adaptation studies. Author

A89-15160

DRIFT-BALANCED RANDOM STIMULI - A GENERAL BASIS FOR STUDYING NON-FOURIER MOTION PERCEPTION

CHARLES CHUBB and GEORGE SPERLING (New York University, NY) Optical Society of America, Journal, A: Optics and Image Science (ISSN 0740-3232), vol. 5, Nov. 1988, p. 1986-2007. refs

(Contract AF-AFOSR-85-0364)

An attempt is made to provide a general theoretical basis and an array of specific tools for studying non-Fourier motion-perception mechanisms. Central to the theoretical framework are the concepts of drift-balanced and microbalanced random stimuli. It is shown that any space-time-separable random (or nonrandom) stimulus is microbalanced, and that any linear combination of pairwise

independent microbalanced random stimuli is microbalanced and drift balanced if the expectation of each component is uniformly zero. K.K.

A89-16124

REGULARITY PROPERTIES OF TIME-OPTIMAL TRAJECTORIES OF AN ANALYTIC SINGLE-INPUT CONTROL-LINEAR SYSTEM IN DIMENSION THREE

H. SCHATTLER (Washington University, Saint Louis, MO) Journal of Optimization Theory and Applications (ISSN 0022-3239), vol. 59, Oct. 1988, p. 135-146. refs

A89-16202#

HUMAN FACTORS ISSUES IN NEW COCKPIT TECHNOLOGY

JOHN K. LAUBER (National Transportation Safety Board, Washington, DC) IN: Radio Technical Commission for Aeronautics, Annual Assembly Meeting and Technical Symposium, Washington, DC, Nov. 17-19, 1987, Proceedings. Washington, DC, Radio Technical Commission for Aeronautics, 1987, p. 33-39. refs

Attention is given to the problems posed for novel aircraft cockpit automated technologies by the questions as to how closely such automatic systems should mimic the performance of human operators in the same task, and the way in which operating modes should be announced and controlled. It is projected that until such questions are answered by a cohesive 'philosophy of automation', automation-related human-error incidents and accidents will proliferate. O.C.

A89-16641

CHANGING STRUCTURE OF PSYCHOPHYSIOLOGICAL INDEXES AS AN INFORMATION SOURCE ON THE PRODUCTIVITY OF MENTAL ACTIVITY [KOLEBATEL'NAIA STRUKTURA PSIKHOFIZICHESKIKH POKAZATELEI KAK ISTOCHNIK INFORMATSII O PRODUKTIVNOSTI UMSTVENNOI DEIATEL'NOSTI]

A. V. KARPENKO (Nauchno-Issledovatel'skii Institut Gigieny Truda i Profzabolevani, Kiev, Ukrainian SSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 14, Sept.-Oct. 1988, p. 730-738. In Russian. refs

This paper presents a new class of criteria for estimating mental work capacity, based on the analysis of psychophysiological indexes, such as the heart rhythm, the vascular tension, the galvanic skin reflex, and the time for processing test information. It is shown that information obtained from monitoring changes in some of these indexes is significantly more meaningful than that obtained from the average values of psychophysiological criteria. I.S.

A89-16642

THE PERSONAL ASPECT IN INTRAGROUP RELATIONSHIPS UNDER THE CONDITIONS OF PARTIAL SOCIAL ISOLATION [LICHNOSTNYI ASPEKT VNUTRIGRUPPOVYKH OTNOSHENII V USLOVIAKH CHASTICHNOI SOTSIAL'NOI IZOLIATSII]

V. I. MEDVEDEV, I. A. BARANOV, and S. T. POSOKHOVA (Voenno-Meditsinskaia Akademiia, Leningrad, USSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 14, Sept.-Oct. 1988, p. 739-746. In Russian. refs

A89-16643

PERSONALITY STRUCTURE IN HUMANS WITH DIFFERENT LEVELS OF FLEXIBILITY OF NEURODYNAMIC PROCESSES [STRUKTURA LICHNOSTI U LIUDEI S RAZLICHNYM UROVNEM PLASTICHNOSTI NEIRODINAMICHESKIKH PROTSESSOV]

A. A. ALDASHEVA (AN KSSR, Institut Fiziologii i Eksperimental'noi Patologii Vysokogor'ia, Frunze, Kirgiz SSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 14, Sept.-Oct. 1988, p. 747-753. In Russian. refs

The role of nervous system flexibility on the individual's adaptability and emotional stability was investigated in 51 men who took part in two Antarctic expeditions, using the 16-factor Cattell questionnaire to characterize individuality traits. The subjects were divided into three groups according to their level of

neurodynamic-process flexibility, using the criteria described by Soroko et al. (1982). It was found that subjects with high levels of neurodynamic flexibility were characterized by sociability, high emotional stability, and high mental activity and were able to organize their activity rationally. Subjects in this category were able to adapt to their social environment through communicational components of their personality, whereas subjects with low-level flexibility of the nervous system could adapt to the social environment mainly through emotional-volitional personality regulation. I.S.

A89-16711
AGE, ALCOHOL, AND SIMULATED ALTITUDE - EFFECTS ON PERFORMANCE AND BREATHALYZER SCORES

WILLIAM E. COLLINS and HENRY W. MERTENS (FAA, Civil Aeromedical Institute, Oklahoma City, OK) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. 1026-1033. refs

The effects of simulated altitude (ground level vs 12,500 ft) and alcohol (2.2 ml of 100-proof vodka per kg body weight, producing breathalyzer readings near 88 mg percent) on the performance of male subjects aged 30-39 or 60-69 years on a multiple-task battery are investigated experimentally. The results are presented in extensive tables and graphs and characterized in detail. Although alcohol impairs the performance of all subjects under all conditions, these effects are greater in the older group; the effects of altitude are insignificant. T.K.

A89-16737
AIRCREW SELECTION SYSTEMS

JEFFREY E. KANTOR and THOMAS R. CARRETTA (USAF, Human Resources Laboratory, San Antonio, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. A32-A38.

This paper describes a computerized battery of psychomotor and cognitive tests designed to identify candidates who would not complete pilot training or not be qualified for a fighter assignment after training. All or some of the battery's 15 tests were given to 1622 USAF pilot candidates prior to training, and their test scores were regressed against various flying performance measures. It was found that two particular psychomotor tests and the tests of perceptual speed, decision making speed, and the memory function are significant predictors of flying performance. An experimental pilot selection system was designed on the basis of these results and was found to have a substantial practical value in reducing attrition from pilot training. I.S.

A89-16739
PROGRAMS AND PROSPECTS IN AIRCREW PERFORMANCE MEASUREMENT

WAYNE L. WAAG (USAF, Human Resources Laboratory, Williams AFB, AZ) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. A46-A51.

This paper describes the R&D activity within the Air Force Human Resources Laboratory directed towards improving the measurement of aircrew performance. Special attention is given to the development of a performance measurement system for the C-5A flight simulator and of an air combat maneuvering performance measurement system that is applicable to both the flight simulator and the instrumented range. Future plans include the development of an air combat assessment and debriefing system. I.S.

A89-16740
THEORY-BASED ABILITY MEASUREMENT - THE LEARNING ABILITIES MEASUREMENT PROGRAM

RAYMOND E. CHRISTAL (USAF, Human Resources Laboratory, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. A52-A58. refs

The USAF Learning Abilities Measurement Program (LAMP) devoted to the development of a theory-based ability measurement system is described. The theoretical framework for this system was developed on the basis of data collected from airmen on 30

cognitive tasks which were previously established by cognitive scientists in colleges and universities. The present availability of microcomputers created a major breakthrough in the state-of-the-art. Examples are provided of recent LAMP studies on processing speed and processing capacity which demonstrate the potential of the system for forecasting individual differences in learning efficiency, performance capabilities, and susceptibility to information overload. I.S.

A89-16741
TECHNICAL INTUITION IN SYSTEM DIAGNOSIS, OR ACCESSING THE LIBRARIES OF THE MIND

SHERRIE P. GOTT (USAF, Human Resources Laboratory, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. A59-A64. refs

This paper discusses the basis of the diagnostic expertise in terms of two types of system diagnosis tasks: (1) human system diagnosis, as practiced by physician problem solvers and (2) nonhuman system diagnosis, as practiced by electronics troubleshooters. It is shown that the diagnostic skill is a function of two interrelated factors, the first of which is a rich integrated structure of knowledge, which can be thought of as a library of the mind. This knowledge stored in memory is procedural in character; that is, attached to the malfunction descriptions are specialized procedures and methods for executing the diagnosis and for prescribing and implementing corrective actions. The instructional approach to the training of electronic troubleshooters is discussed. I.S.

N89-12194# Paris II Univ., Orsay (France). Recherche En Informatique.

IMPROVING THE TOOLS OF SYMBOLIC LEARNING Final Report, 1985 - 1987

YVES KODRATOFF 1 Sep. 1987 36 p
 (Contract DAJA45-85-C-0014; DA PROJ. 1L1-61102-BH-57)
 (AD-A192254; LRI-321; ARDG(E)-R/D-4624-CC-01) Avail: NTIS HC A03/MF A01 CSCL 23B

Concepts relating to symbolic machine learning (ML) are discussed in this report. These concepts include knowledge representation, descriptive notations, and methods of generalization. ML techniques have been applied to scene analysis through implementation of a system that learns features in order to recognize multi-font characters. Highlights of this research are discussed. In its first part, this paper presents some consequences of the choice of the definition of Generalization. It discusses the definitions based on deduction, versus those based on substitution. In its second part, it shows how symbolic computations are also able to take into account, at least partly, the noise most real-life data show. It discusses symbolic approaches to noise handling in Scene Analysis, rule learning, strategy learning and, finally, of the idea of polymorphic Version Space. GRA

N89-12195# Katholieke Universiteit, Nijmegen (Netherlands). Psychologisch Lab.

ROLE OF CONCENTRATION IN SIMPLE MENTAL TASKS: AN EXPERIMENTAL TEST OF SOME MODELS

G. J. P. VANBREUKELLEN and R. W. T. L. JANSEN 1987 42 p
 (PB88-208962; REPT-87-MA-08) Avail: NTIS HC A03/MF A01 CSCL 05I

To explain response time (RT) fluctuations in continuous performance on routine mental tasks such as concentration and mental speed tests, Pieters and Van der Ven (1982) proposed the Poisson-Erlang model. The model assumes that RT fluctuations on such tasks are mainly due to distractions. Van der Ven, Smit, and Jensen (1987) developed a modification of the Poisson-Erlang model, the inhibition model, which can accommodate monotone trend in RT-series. The present experiment served to test both models as well as the distraction hypothesis in general. Subjects were given the Bourdon concentration test in an experimental format. Experimental factors were massed vs spaced work and a bonus for improvement of speed without loss of precision. The results support the distraction hypothesis and globally the models as well,

although the models need some modification. Implications for RT studies as well as mental testing are discussed, and some suggestions are given for extending the models. GRA

N89-12196# Air Force Inst. of Tech., Wright-Patterson AFB, OH.

AN EMPIRICAL INVESTIGATION OF THE IMPACT OF THE ANCHOR AND ADJUSTMENT HEURISTIC ON THE AUDIT JUDGMENT PROCESS Ph.D. Thesis

ANTHONY H. PRESUTTI, JR. 1988 93 p
(AD-A196481; AFIT/CI/NR-88-162) Avail: NTIS HC A05/MF A01 CSDL 12C

This research investigated the operation of the anchor and adjustment heuristic in the environment of the continuing audit engagement. Specifically, the impact of information concerning the previous year's compliance test results was measured over several reported error rates from the current year's compliance test results. The experimental instrument was applied to two classes of participants, audit practitioners from both public accounting and a government audit service. Each participant was required to supply an estimate of the total population error rate using the information given and the risk assessment methodology. The results of this empirical investigation determined that the addition of prior year information appears to moderate the impact of the anchor and adjustment heuristic by reducing the participants' confidence that the statistical sample error rate represents an acceptable population error rate. GRA

N89-12197# Educational Testing Service, Princeton, N. J.
THE INFORMATION MATRIX IN LATENT-VARIABLE MODELS
ROBERT J. MISLEVY and KATHLEEN M. SHEEHAN Apr. 1988 38 p

(Contract N00014-85-K-0683; PROJ. RR0-4204)
(AD-A196609; RR-88-24-ONR) Avail: NTIS HC A03/MF A01 CSDL 05H

The information matrix for the parameters in a latent-variable model is bounded from above by the information that would obtain if the values of the latent variables could also be observed. The difference is the missing information. This paper discusses the structure of the information matrix, and characterizes the degree to which missing information can be recovered by exploiting collateral variables for respondents. The results are illustrated with data from the Armed Services Vocational Aptitude Battery. GRA

N89-12765# State Univ. of New York, Buffalo. Dept. of Psychology.

THE EFFECT OF ATTENTIONAL FOCUS LEVEL ON TASK PERFORMANCE UTILIZING INFORMATION FROM DIFFERENT STIMULUS STRUCTURE LEVELS Final Report

DEBORAH A. GAGNON /n Universal Energy Systems, Inc., United States Air Force Graduate Student Summer Support Program, Volume 1 21 p Dec. 1987
Avail: NTIS HC A99/MF E03 CSDL 05I

An experiment is described that will allow for the analysis of performance on an object and scene two-alternative forced choice task under different stimulus structure attention focuses. Seventeen subjects participated in a pilot study at the State University of New York at Buffalo. Suggestions for a data analysis are made. Author

N89-12770# San Diego State Univ., Calif. Dept. of Psychology.
DESIGNING SIMULATOR TASKS TO STUDY THE HIGH SPEED, LOW ALTITUDE ENVIRONMENT Final Report

LAURA GIUSTI /n Universal Energy Systems, Inc., United States Air Force Graduate Student Summer Support Program, Volume 1 12 p Dec. 1987
Avail: NTIS HC A99/MF E03 CSDL 05I

An experiment was designed as an instrument to measure the effectiveness of proposed experimental training regimes and display designs. A computer simulation of a terrain-following, terrain-avoidance task was used to determine the subjects' capabilities in the high-speed, low altitude flying environment. Subjects controlled only the pitch and altitude of their aircraft and

were instructed to successfully maneuver over and between twenty equidistant buildings. Preliminary results suggest that the task will be an effective measure for evaluating training regimes and display designs. Author

N89-13137# Washington Univ., St. Louis, Mo. Dept. of Neurology.

IS WORD RECOGNITION AUTOMATIC: A COGNITIVE-ANATOMICAL APPROACH

MICHAEL I. POSNER, JENNIFER SANDSON, MEENA DHAWAN, and GORDON L. SHULMAN 30 May 1988 35 p
(Contract N00014-86-K-0289; RR04206)
(AD-A197089; TR-88-4-ONR) Avail: NTIS HC A03/MF A01 CSDL 06D

It is generally accepted that two tasks will interfere to the extent that they require attention or involve shared non-attentional processing systems. The authors used anatomical data from studies of blood flow during lexical processing to generate hypotheses about the conditions under which an auditory shadowing task would interfere with three common visual priming tasks. Data from blood flow studies suggest that visual priming involves automatic activation of a set of posterior visual areas that are not activated by auditory language processing. In accord with this account, we found no reduction in visual priming during simultaneous shadowing. Cueing covert visual attention involves posterior parietal areas that are not involved in auditory shadowing. However, these posterior areas are part of a unified attention system. In accord with this idea, cueing covert attention is greatly affected by simultaneous auditory shadowing. Blood flow data indicate that semantic involves both an anterior attention system and an area of lateral frontal cortex. Both these areas can also be activated by auditory information. GRA

N89-13138# Georgia Inst. of Tech., Atlanta.
CONSEQUENCES OF INDIVIDUAL DIFFERENCES IN BRAIN ORGANIZATION FOR HUMAN PERFORMANCE Interim Report, Jul. 1986 - Jul. 1987

JOANNE GREEN, PHILIP D. WEST, DAVID C. HARTUP, and DENNIS F. FOLDS Jul. 1988 127 p
(Contract MDA903-86-K-0320; DA PROJ. 2Q1-61102-B-74-F)
(AD-A197667; ARI-RN-88-47) Avail: NTIS HC A07/MF A01 CSDL 06D

This research note summarizes the work done during the first year of a four-year research program to identify how measurement of brain functioning, especially individual differences in brain functioning, can be used to understand and predict human performance in complex human machine systems. A major objective of the completed work was to define measures which identify characteristics of individual brain functioning. The results suggest that electrophysiological measures have the greatest potential to measure performance related aspects of brain functioning. Given the sensitivity of the electrophysiological measures to variation in brain functioning, and their potential as measures of workload, it is planned to include further evaluation of these measures in future work, as indices of performance related aspects of brain functioning. GRA

N89-13139# Johns Hopkins Univ., Baltimore, Md. Dept. of Physiology.

PREATTENTIVE AND ATTENTIVE VISUAL INFORMATION PROCESSING Interim Report, 1 Apr. 1987 - 31 Mar. 1988

HOWARD E. EGETH 15 Jun. 1988 62 p
(Contract AF-AFOSR-0180-87; AF PROJ. 2313)
(AD-A197670; AFOSR-88-0726TR) Avail: NTIS HC A04/MF A01 CSDL 05H

Twelve (12) experiments are described in this report. The first nine (9) are concerned with the hypothesis that the identification of the values of stimulus features in multielement visual displays requires serial processing. Contrary to this hypothesis, the weight of the evidence suggests that feature identification can be carried out by spatially parallel processes. The remaining three (3) experiments are concerned with the ability to extract semantic information from several stimuli in parallel. Both alphanumeric

character classification and lexical (i.e., word vs. nonword) decisions can be accomplished by parallel processes, but semantic categorization of words cannot. The implications of these findings for theories of attention are discussed. GRA

N89-13140# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hamburg (West Germany). Abteilung Luft- und Raumfahrtpsychologie.

DIFFERENTIAL-PSYCHOLOGICAL ANALYSIS OF A COMPUTER-BASED AUDIO-VISUAL TEST OF VIGILANCE

PETER MASCHKE and GEORG FINELL May 1988 48 p In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-1136) (DFVLR-FB-88-23; ISSN-0171-1342; ETN-88-93523) Avail: NTIS HC A03/MF A01; DFVLR VB-PL-DO, 90 60 58, 5000 Cologne, Federal Republic of Germany, 18 deutsche marks

An audio-visual test of vigilance, in which visual (indicator deflections) and auditory (letter) signals are presented simultaneously, is evaluated with regard to its differential and diagnostical value. The sample consisted of 261 airline pilot and 241 air traffic controller applicants. Correlation and factor analyses with reference tests suggest the existence of two independent constructs of vigilance: signal detection and false alarms. In both modalities and in both samples these scores prove to be sufficiently reliable. ESA

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

A89-12976#

TRENDS IN THE DEVELOPMENT OF LIFE-SAVING EQUIPMENT IN AVIATION [TENDENCJE ROZWOJOWE SPRZETU RATUNKOWEGO W LOTNICTWIE]

JANUSZ JANKOWSKI and MIROSLAW NAPURKA (Instytut Techniczny Wojsk Lotniczych, Warsaw, Poland) Technika Lotnicza i Astronautyczna (ISSN 0040-1145), vol. 43, March 1988, p. 3-6. In Polish. refs

The development of life-saving equipment in military aviation in Poland is described. Particular attention is given to the development of protective suits, life jackets, ejection seats, and helmets. B.J.

A89-14856

DINING IN THE STARS

BETTY NOLLEY Space World (ISSN 0038-6332), vol. Y-11-299, Nov. 1988, p. 13-16.

The process of food service planning for the Space Station is examined. The preparation of food aboard the Station, methods for keeping food fresh for long periods of time, and alternatives to dehydrated food are considered. Taste tests, menu selection, and the food served on the Space Shuttle are discussed and sample menus are presented. R.B.

A89-14999

INTEGRATION OF DEPTH MODULES - STEREO AND SHADING

HEINRICH H. BULTHOFF and HANSPETER A. MALLOT (MIT, Cambridge, MA) Optical Society of America, Journal, A: Optics and Image Science (ISSN 0740-3232), vol. 5, Oct. 1988, p. 1749-1758. refs
(Contract N00014-85-K-0214; DFG-MA-1038/1-1/2; NATO-0403/87)

The integration of image disparities, edge information, and shading in the three-dimensional perception of complex yet well-controlled images generated with a computer-graphics system

is studied. The images revealed end-on views of flat- and smooth-shaded ellipsoids, i.e., images with and without intensity discontinuities (edges). A map of perceived depth was measured by adjusting a small stereo depth probe interactively to the perceived surface. The data indicate that disparate shading yields a vivid stereoscopic depth perception, even in the absence of disparate edges. K.K.

A89-15114

SPACE-CABIN ATMOSPHERE AND EVA [ATMOSPHERE D'UNE CABINE SPATIALE ET SORTIE EXTRA-VEHICULAIRE]

H. MAROTTE (Centre d'Essais en Vol, Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge, France) and M. WEIBEL (Avions Marcel Dassault-Breguet Aviation, Saint-Cloud, France) L'Aeronautique et l'Astronautique (ISSN 0001-9275), no. 131, 1988, p. 4-11. In French. refs

The conditions for aeroembolism formation are reviewed, and preventive measures are discussed with respect to pressure-suit and pressurization-system design. A discrepancy exists between the requirements for space cabin pressurization and EVA. Decompression sickness during EVA can be prevented by either direct denitrogenation or a mixed procedure. The EVA requirements of the Space Station dictate a pressure-suit pressure of 659 hPa, while the requirements of Hermes dictate a pressure of about 400-450 hPa. For the case of an emergency EVA pressure suit, the highest possible pressure is recommended as a means of preventing aeroembolism formation. R.R.

A89-15115

TASKS PROJECTED FOR SPACE ROBOTS AND AN EXAMPLE OF ASSOCIATED ORBITAL INFRASTRUCTURE [TACHES ENVISAGEES POUR LES ROBOTS SPATIAUX ET EXEMPLE D'INFRASTRUCTURE ORBITALE ASSOCIEE]

P. DUTTO (CNES, Toulouse, France) L'Aeronautique et l'Astronautique (ISSN 0001-9275), no. 131, 1988, p. 12-20. In French.

Following a review of the orbital infrastructure projected up to the beginning of the 21st century, the application of robotics to manned and unmanned missions is discussed. Particular attention is given to the Space Station, MIR, the attached pressurized module, Hermes, and Ariane V. The use of AI to increase the level of autonomy and automation of space systems is considered. Possible roles for robotic systems include routine activities on manned and unmanned space flights, the execution of dangerous tasks (such as those on platforms exposed to elevated radiation levels or those involving nuclear reactors), and probing on distant missions. R.R.

A89-15777

NEW DESIGNS OF HOLOGRAPHIC HELMET DISPLAYS

Y. AMITAI, A. A. FRIESEM, and V. WEISS (Weizmann Institute of Science, Rehovot, Israel) IN: Holographic optics: Design and applications; Proceedings of the Meeting, Los Angeles, CA, Jan. 13, 14, 1988. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1988, p. 12-19. refs

The holographic elements used by helmet displays employing monochromatic light must perform over a wide field-of-view, and suffer from severe aberrations that entail the holographic recording of complex waveforms. Attention is presently given to a recursive design technique for obtaining the desired complex waveform on the basis of comparatively simple intermediate holograms; the technique is based on changing the geometries and the wavelength between the recording and readout of intermediate holograms. O.C.

A89-15784

HOLOGRAPHIC LASER-PROTECTIVE EYEWEAR

JAMES M. TEDESCO (Kaiser Optical Systems, Inc., Ann Arbor, MI) IN: Holographic optics: Design and applications; Proceedings of the Meeting, Los Angeles, CA, Jan. 13, 14, 1988. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1988, p. 163-170.

An evaluation is made of the relative merits of various exposure

and substrate configurations for laser-protective eyewear, emphasizing single-beam exposure surface-conformal fringe structures in which the local Bragg angle is determined by the fringe spacing as opposed to the fringe tilt. Performance is evaluated in terms of visual transmittance vs eye protection, including retinal area and eye rotation. The relationship between angular and spectral response of holographic laser filters indicates that the exposure source for optimum performance approximates the center of eye rotation, irrespective of substrate geometry.

O.C.

A89-16197* National Aeronautics and Space Administration, Washington, D.C.

HUMAN FACTORS FOR MARS MISSIONS

ARNAULD E. NICOGLOSSIAN (NASA, Life Sciences Div., Washington, DC) IN: The NASA Mars Conference. San Diego, CA, Univelt, Inc., 1988, p. 475-484.

(AAS PAPER 86-176)

The implications of human participation in Mars missions are reviewed. The psychological effects of long-term confinement, tension, and boredom are examined. The medical implications of travel to Mars, including the effects of low gravity and exposure to radiation, are discussed. The difficulty of providing sufficient consumables, such as air, food, and water, is considered. R.B.

A89-16198

MARS MISSION LIFE SUPPORT

PENELOPE J. BOSTON (National Center for Atmospheric Research, Boulder, CO) IN: The NASA Mars Conference. San Diego, CA, Univelt, Inc., 1988, p. 487-507.

(AAS PAPER 86-177)

Life support systems for Mars missions and a Mars base are discussed. The use of in situ resources on Mars, the managed ecosystem approach, greenhouses, respiratory gas exchange with human habitats, plant environments, microbial processing, recycling, and system insurance are considered. Issues concerning food production in the Martian radiation environment are examined, including the selection of potential food organisms and the potential of hydroponic/aeroponic plant growth. R.B.

A89-16628

ADAPTING THE FORM OF INFORMATION PRESENTED TO THE OPERATOR IN MAN-MACHINE SYSTEMS [OB ADAPTATSII FORMY PREDSTAVLENIYA INFORMATSII OPERATORU V CHELOVEKO-MASHINNYKH SISTEMAKH]

S. V. ASTANIN and V. G. ZAKHAREVICH (Taganrogskii Radiotekhnicheskii Institut, Taganrog, USSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 74, 1987, p. 71-76. In Russian. refs

This paper examines the problem of adapting a particular form of information flow presented to the operator to the operator's personality and the state of the object regulated by the operator. An approach based on cluster analysis is presented, which shows the relationship between the form of information presentation, the psychological state of the operator, and the nature of the problem that must be solved. I.S.

A89-16631

INTERNAL MODELS OF HUMAN DECISION MAKING AND MOTOR ACTIVITY IN PROBLEMS OF MANUAL CONTROL [VNUTRENNIE MODELI PRINIATIIA RESHENII I DVIGATEL'NOI AKTIVNOSTI CHELOVEKA V ZADACHAKH RUCHNOGO UPRAVLENIYA]

IU. V. PARAMONOV and V. A. CHERNOMORETS (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 76, 1987, p. 54-62. In Russian. refs

An analysis is made of methodological aspects of the development of general-purpose information and motor-activity models for a human operator in the case of the manual control of dynamic objects. It is suggested that the theory of motor response developed here can be related conceptually to the process of human decision making. B.J.

A89-16633

SEQUENTIAL STRATEGY FOR MATCHING THE CHARACTERISTICS OF A MAN-MACHINE SYSTEM [POSLEDOVATEL'NAIA STRATEGIYA SOGLASOVANIYA KHARAKTERISTIK SISTEMY CHELOVEK-MASHINA]

V. V. PAVLOV and D. I. PALEICHUK (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 76, 1987, p. 92-97. In Russian.

A method for matching man-machine characteristics is proposed which is based on the generalizing working characteristics of a human operator. Different ways to include the matching elements and the human operator in the control loop are examined. The development of an aircraft landing control system is considered as an example. B.J.

N89-12198# Army Research Inst. of Environmental Medicine, Natick, MA.

PHYSIOLOGICAL RESPONSES TO A PROTOTYPE HYBRID AIR-LIQUID MICROCLIMATE COOLING SYSTEM DURING EXERCISE IN THE HEAT

BRUCE S. CADARETTE, ANDREW J. YOUNG, BARRY S. DECRISTOFANO, KAREN L. SPECKMAN, and MICHAEL N. SAWKA Apr. 1988 32 p

(AD-A194759; USARIEM-T-12/88) Avail: NTIS HC A03/MF A01 CSCL 06P

The effectiveness of a prototype air-liquid hybrid microclimate cooling system was compared to previously developed air- and liquid-cooled systems to assess heat stress reduction during physical exercise. This hybrid system could be used by combat vehicle crewmen needing both types of cooling for mounted and dismounted activities. All subjects completed the 120 minutes of exercise with all four microclimate cooling systems. The data demonstrate that the prototype air-liquid hybrid microclimate cooling system allowed the same endurance time (ET) as the air (A) and liquid (L) systems. However, the small but significantly greater thermal strain shown with the hybrid-liquid configuration relative to the air (A) system indicates a potential need for an alteration in the amount of cooling provided for the HL configuration, as it had lowest calculated cooling capacity of all the systems. GRA

N89-12199*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

STEREO DEPTH DISTORTIONS IN TELEOPERATION

DANIEL B. DINER and MARIKA VONSYDOW 15 May 1988 57 p

(Contract NAS7-918)

(NASA-CR-180242; JPL-PUB-87-1-REV-1; NAS 1.26:180242)

Avail: NTIS HC A04/MF A01 CSCL 05H

In teleoperation, a typical application of stereo vision is to view a work space located short distances (1 to 3m) in front of the cameras. The work presented here treats converged camera placement and studies the effects of intercamera distance, camera-to-object viewing distance, and focal length of the camera lenses on both stereo depth resolution and stereo depth distortion. While viewing the fronto-parallel plane 1.4 m in front of the cameras, depth errors are measured on the order of 2cm. A geometric analysis was made of the distortion of the fronto-parallel plane of divergence for stereo TV viewing. The results of the analysis were then verified experimentally. The objective was to determine the optimal camera configuration which gave high stereo depth resolution while minimizing stereo depth distortion. It is found that for converged cameras at a fixed camera-to-object viewing distance, larger intercamera distances allow higher depth resolutions, but cause greater depth distortions. Thus with larger intercamera distances, operators will make greater depth errors (because of the greater distortions), but will be more certain that they are not errors (because of the higher resolution). Author

N89-12200 New South Wales Univ., Kensington (Australia).

ADAPTATION IN THE HUMAN ACCOMMODATION SYSTEM Ph.D. Thesis

RICHARD K. T. TAN Jan. 1988 3 p

Avail: Issuing Activity

The dark focus and adaptation in the ocular accommodation system is examined. The aspects governing dark focus positioning was found to be important. In the adaptation studies, one of the issues examined was whether the dark focus plays a important part in the accommodation system. This issue was resolved by studying dark focus and the close-loop accommodation system concurrently in their habitual and adapted states. The dark focus was found to be influenced by the level of premeasurement accommodation. The effect is dependent on the magnitude and direction of accommodation response from the dark focus and the duration of sustained accommodation. With reference to the dark focus level, positive accommodation resulted in a bigger shift than negative accommodation. When the temporal stability of the dark focus was studied, it was found that dark focus position was determined by the accommodative history of the individual. The unadapted accommodation system showed that the dark focus is located at the pivot of the accommodative response stimulus curve. During near work, the gain of the accommodative response curve decreases as the height of the response increases. Author

N89-12201# Aerospace Medical Research Labs., Wright-Patterson AFB, OH.

THE EFFECTS OF BIODYNAMIC STRESS ON WORKLOAD IN HUMAN OPERATORS Final Report, Dec. 1986 - Aug. 1987

WILLIAM B. ALBERY Jan. 1988 239 p
(AD-A196720; AAMRL-TR-88-004) Avail: NTIS HC A11/MF A01 CSCL 06J

The objective of this research was to assess the effect of high intensity noise stress and of sustained acceleration on human operator workload and performance. Workload was measured via three different methodologies. Subjective workload was measured with the Subjective Workload Assessment Technique (SWAT); performance-based measures were derived from single and dual psychomotor task performance; and physiological parameters included heart rate, blood pressure, total eye blinks duration, forearm electromyogram and evoked response EEG, especially the latency and amplitude of the P300 peak. The dual task workload consisted of a primary tracking task and a secondary task of monitoring a modified Radar Homing and Warning display. Two levels of pink noise (90 and 100 dB A-weighted) and two levels of sustained acceleration (2.75 and 3.75 Gz) served as the biodynamic stressors. Nine subjects performed the dual task in the Armstrong Aerospace Medical Research Laboratory human centrifuge. Exposures were 60 seconds long during which time subjects' noninvasive physiological parameters were monitored in either noise or acceleration conditions. The results indicate that biodynamic stressors such as noise and acceleration adversely affect subjective operator workload without affecting objective task performance and that physiological workload measures such as eye blink and blink duration are ineffective in the acceleration environment. GRA

N89-12202# Klein Associates, Yellow Springs, Ohio.
PREDICTION MODEL FOR ESTIMATING PERFORMANCE IMPACTS OF MAINTENANCE STRESS Interim Technical Paper, May - Oct. 1986

JANET TAYNOR, GARY A. KLEIN, and CHERYL L. BATCHELOR
Jun. 1988 36 p
(Contract F33657-84-D-0315)
(AD-A196798; AFHRL-TP-88-5) Avail: NTIS HC A03/MF A01 CSCL 05I

An Identification Point modelling tool was constructed to assist Air Force planners to predict the effects of stress upon aircraft maintenance time. Preparedness for the hazard, experience of the maintenance technicians, payoff for performing the task quickly, task complexity, and the need for others to complete the task were combined to produce 32 identification points in the model. The Comparison Based Prediction method was used to obtain information from maintenance experts in industry, Air National Guard experts, and civilian fire vehicle maintainers. The model describes and predicts the effects upon maintenance time of various combinations of the five factors. Future combat conditions may expose maintenance technicians to hazards such as bombs,

bullets, and nuclear/biological/chemical (NBC) warfare conditions. The speed and manner of aircraft maintenance task performance under these conditions are critical determinants of how fast aircraft can be returned to combat. The speed at which aircraft can be turned around during normal operations and during simulated surge conditions can be studied and the data used to calculate sortie rates. The study of performance of even routine maintenance tasks in this type of environment must take into account the effects of psychological stress. Because the effects of psychological stress upon maintenance personnel can have a critical impact upon the time needed to return aircraft to battle, the effect of such stress must be addressed. GRA

N89-12203# Naval Air Development Center, Warminster, Pa. Air Vehicle and Crew Systems Technology Dept.

FIRE TESTS OF ADVANCED ARAMID BLENDS AND TREATMENTS Final Report

GEORGE H. KYDD and JOAN C. MARANO-GOYCO Dec. 1987 53 p
(AD-A197512; NADC-87179-60) Avail: NTIS HC A04/MF A01 CSCL 11E

Full scale fuel fire pit tests were performed on three different groups of flight suits. The purpose of these tests was to compare the fire protective quality, as related to percent body burned, or super flame-resistant nomex blends. The materials tested were: (1) Super flame resistant nomex, (2) PBI (Polybenzimidazole) - Super flame resistant nomex, (3) Super flame resistant nomex camouflage and (4) Nomex III, tested as a control. Nomex III is a 95/5 percent Nomex-Kevlar blend and is the standard sage green 27P flight suit currently being used by Navy and Air Force. The tests were conducted at the Naval Air Development Center's Facility and the suits were subjected to three second exposures using JP-4 fuel. One of the camouflage suits was tested at four seconds. GRA

N89-12204# Aerospace Medical Research Labs., Wright-Patterson AFB, OH.

ANTHROPOMETRY AND MASS DISTRIBUTION FOR HUMAN ANALOGUES. VOLUME 1: MILITARY MALE AVIATORS Final Report

Mar. 1988 76 p
(AD-A197650; AAMRL-TR-88-010-VOL-1) Avail: NTIS HC A05/MF A01 CSCL 05I

Anthropometric and mass distribution data for use in constructing three-dimensional human analog, i.e., mathematical models or test dummies, are presented in this report. Included here are body dimensions, joint locations, and mass distribution properties appropriate for modeling the Small, Mid-size, and Large male aviator of the 1980s. The data were derived from: (1) 130 body dimensions of standing and seated males obtained by traditional anthropometric methods; (2) mass distribution data for body segments obtained by stereophotographic techniques; and (3) skeletal joint centers obtained by estimation. The anthropometric data, generated from multiple regressions on stature and weight, are suitable as the basis for models to be used in testing responses to impact and other mechanical forces; they are not recommended for other purposes such as the sizing of clothing and personal protective equipment, or workspace design. GRA

N89-12205# Army Research Inst. of Environmental Medicine, Natick, MA.

THE PHYSIOLOGICAL DETERMINANTS OF LOAD BEARING PERFORMANCE AT DIFFERENT MARCH DISTANCES Technical Report, Sep. - Nov. 1986

ROBERT P. MELLO, ANDREW I. DAMOKOSH, KATY L. REYNOLDS, CALVIN E. WITT, and JAMES A. VOGEL Apr. 1988 38 p
(AD-A197733; USARIEM-T-15/88) Avail: NTIS HC A03/MF A01 CSCL 23B

The purpose of this study was to further knowledge of the physiological determinants of load bearing performance over distances from 2 to 12 km. Twenty eight soldiers, experienced in load bearing, were initially assessed for: aerobic power (VO2max),

leg strength and muscular endurance, maximal lift capacity, maximal heart rate (HRmax), body composition, body anthropometry, and submaximal treadmill response to load bearing. Following a week of fitness assessment, each soldier performed four, best effort, load bearing trials at distances of 2, 4, 8 and 12 km. All trials were scheduled in random order on four successive weeks. The total load carried (pack, weapon, and clothing) was 46.12 kg. Mean performance times for each distance were 16.0, 35.1, 77.2 and 125.0 minutes, respectively. Mean exercise intensity (percent HRmax) as measured by HR telemetry for each trial was 74, 71, 69 and 63 percent respectively. GRA

N89-12206*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

HAZARDS PROTECTION FOR SPACE SUITS AND SPACECRAFT Patent Application

JOSEPH J. KOSMO, inventor (to NASA) and FREDERICK S. DAWN, inventor (to NASA) 30 Jun. 1988 16 p (NASA-CASE-MSC-21366-1; NAS 1.71:MSC-21366-1; US-PATENT-APPL-SN-213880) Avail: NTIS HC A03/MF A01 CSCL 06K

A flexible multi-layered covering for protection against the hazards of exposure to the environment of outer space is presented. The covering includes an outer layer section comprising an outmost lamina of woven expanded tetrafluorethylene yarns (Gore-Tex) for protecting against abrasion and tearing, an underlying weave of meta-aramid yarns (Nomex) and para-aramid yarns (Kevlar) for particle impact protection, an electrostatic charge dissipation and control system incorporated therein, and a chemical contaminants control barrier applied as a coating. A middle section includes a succession of thermal insulating layers of polymeric thermoplastic or thermoforming material, each of which is coated with a metal deposit of high infrared emissivity and low solar radiation absorption characteristics and separated from adjacent insulating layers by a low thermal conductance material. The covering includes a radiation attenuating layer of a tungsten-loaded polymeric elastomer binder for protecting against bremsstrahlung radiation and an inner layer of rip-stop polyester material for abrasion protection. A chloroprene coating may be supplied by polyester-material for added micrometeoroid protection. Securing the means of low heat conductance material secures the multi-layers together as a laminar composite. NASA

N89-12207*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A SURVEY OF SOME REGENERATIVE PHYSICO-CHEMICAL LIFE SUPPORT TECHNOLOGY

THEODORE WYDEVEN Nov. 1988 43 p (NASA-TM-101004; A-88189; NAS 1.15:101004) Avail: NTIS HC A03/MF A01 CSCL 06K

To date, manned spaceflight has used the relatively simple support methodology of bringing all the necessary water, oxygen, and food for the duration of the mission, and collecting and storing waste products for return to Earth. This is referred to as an open system. It was recognized early, as manned missions became longer and crew size increased, that the weight, volume, and transportation penalties of storing or routinely resupplying consumables would at some point become too expensive. Since the early 1960's regenerative ECLSS technology has been under development, and there now exists a foundation in both systems definition and subsystem technology to support long-duration manned missions. In many cases this development has reached the engineering prototype stage for physico-chemical subsystems and in this article some of these subsystems are described. Emphasis is placed on physico-chemical waste conversion and related processes which provide sustenance and not on environmental factors or subsystems, e.g., temperature and humidity control, spacecraft architecture, lighting, etc. Author

N89-12208# Southampton Univ. (England). Human Factors Research Unit.

PERFORMANCE WITH HELMET-MOUNTED SIGHTS

M. J. WELLS and M. J. GRIFFIN Sep. 1987 126 p (ISVR-TR-152; ETN-88-93546) Avail: NTIS HC A07/MF A01

More than 30 experiments concerned with the effects of vibration, and other variables, on the use of helmet-mounted sights are presented. The other variables include target size, target position and target motion, reticle size, reticle position (elevation), reticle shape and the eye of presentation of the reticle (eye dominance), performing a secondary task (talking), type of seat, wearing personal equipment (life support jacket, helmet, oxygen mask), and helmet mass. Data are also provided on the possible use of the helmet-mounted sight during air-to-air engagements and on the benefits of the combined use of the head and eyes to track and acquire targets. Published studies of the use of the helmet-mounted sight in the laboratory and in-flight are reviewed. ESA

N89-12762# Alabama Univ., Tuscaloosa. Dept. of Health Education.

VALIDITY OF HEAT INDEX AS INDICATOR OF LEVEL OF HEAT STORAGE FOR PERSONNEL WEARING PROTECTIVE CLOTHING IN HOT ENVIRONMENTS Final Report

K. SUZANNE ENLOW In Universal Energy Systems, Inc., United States Air Force Graduate Student Summer Support Program, Volume 1 18 p Dec. 1987

Avail: NTIS HC A99/MF E03 CSCL 05H

The use of protective clothing such as the Chemical Defense Ensemble (CDE) in moderate to hot environments substantially reduces work capacity due to heat stress. The purpose of this research was to determine the validity of a heat stress index in predicting the level of heat storage when used during work/rest cycles with intermittent microenvironmental cooling. Author

N89-12776# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.

A SYSTEM TO INVESTIGATE SYNTHESIZED VOICE FEEDBACK IN MAN-MACHINE INTERFACES Final Report

MICHELE E. JOHNSON In Universal Energy Systems, Inc., United States Air Force Graduate Student Summer Support Program, Volume 1 17 p Dec. 1987

Avail: NTIS HC A99/MF E03 CSCL 05H

The Rome Air Development Center (RADC), Intelligence Analysis Branch, is sponsoring an in-house research effort to study and develop advanced man-machine interfaces. At present, most interfaces consist of a keyboard and a display terminal, and feedback to a user is visual. Verbal dialog is an alternative interface that has the potential to reduce the human operator's visual load, and to take advantage of the verbal communication skills that almost every human being possesses. This paper described the elements of a system that RADC will use to investigate verbal feedback to a human operator, more specifically to examine the interactions between synthesized message characteristics and the performance of tasks requiring comprehension of audio information. Author

N89-13141*# Eagle Engineering, Inc., Houston, Tex.

LUNAR STORM SHELTER CONCEPTUAL DESIGN

1 May 1988 92 p

(Contract NAS9-17878)

(NASA-CR-172078; NAS 1.26:172078; EEI-88-189) Avail: NTIS HC A05/MF A01 CSCL 06K

The requirements for a radiation protection program for the exploration and permanent occupancy of the lunar surface are described. B.G.

N89-13142# Naval Postgraduate School, Monterey, Calif.

THREE-DIMENSIONAL VISUAL DISPLAY FOR A PROTOTYPE COMMAND AND CONTROL WORKSTATION M.S. Thesis

MILTON D. ABNER Jun. 1988 68 p

(AD-A197319) Avail: NTIS HC A04/MF A01 CSCL 25E

The development of a real-time three-dimensional visual display for the Command and Control Workstation of the Future (CCWF) is a means of rapidly interpreting large amounts of important information. In this study, we examine the realistic versus real-time

trade-offs required to achieve such a display and the components effecting these trade-offs, i.e., hidden surface technique, lighting and shading models, etc. We also present a unified data structure that is used in storing various properties that create the display.

GRA

N89-13143# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.

AUTOCREW IMPLEMENTATION: INBOUND SURFACE-TO-AIR MISSILE SIMULATION Interim Technical Report

BRENDA L. BELKIN May 1988 45 p

(Contract DAAG29-84-K-0048)

(AD-A197674; ARO-20155.16-MA) Avail: NTIS HC A03/MF A01 CSDL 121

Nine multiple cooperating rule-based systems for the combat aircraft environment were developed and implemented in the AUTOCREW expert system. Each component rule-based system is modelled on a typical World War II bomber crew member having specific task responsibilities. The bases for modelling integrated rule-based systems as crew members are twofold. First, tasks performed by crew members are easily identified, well-defined, and familiar to operations personnel and aircraft system designers. The issue of task familiarity is essential from a human engineering standpoint. The pilot of a single-seat combat aircraft categorizes the tasks he performs into logical groups such as navigation, flight control, systems monitoring, failure diagnosis, and fire control operations. Implementing an AI-based pilot aid as a logical extension of human operations is highly desirable. The pilot must identify with the task performed by the on-board aid, so a crew-model design of component knowledge bases is commensurate with the pilot's experience and training. The modelled crew members are COPILOT (flight control), ENGINEER (system diagnosis, reconfiguration), NAVIGATOR (navigation), COMMUNICATOR (radio/data operations), OBSERVER (lookout and alarm) ATTACKER (offensive weapon control), DEFENDER (defensive weapon control), and SPOOFER (countermeasures). The ninth rule-based system (EXECUTIVE) coordinates mission-specific tasks and has knowledge of the mission plan.

GRA

55

SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

A89-14389

PRODUCTION OF AMINES BY PROTON BOMBARDMENT OF SIMPLE GAS MIXTURES

N. SACK, R. SCHUSTER, A. HOFMANN (Erlangen-Nuernberg, Universitaet, Erlangen, Federal Republic of Germany), and H.-J. SCHNEIDER (Pharmacia LKB GmbH, Freiburg im Breisgau, Federal Republic of Germany) Icarus (ISSN 0019-1035), vol. 76, Oct. 1988, p. 110-117. refs

Various gas mixtures involving CH₄, N₂, H₂O, NH₃, CH₃OH, and CHOOH, are presently bombarded with protons having incident energies of between 5 and 11 MeV, and current densities between 3 and 9 microampere/sq cm in order to ascertain general amine-production properties and the specific extent of amino acid generation. A significant increase in yield of amino acids is noted with increasing current density; no dependence on proton incident energy is found. Amine production probability for different functional groups is sensitive to both qualitative and quantitative variations of the primary gas mixture.

O.C.

A89-16184

THE BIOLOGICAL QUESTION OF MARS

NORMAN H. HOROWITZ IN: The NASA Mars Conference. San Diego, CA, Univelt, Inc., 1988, p. 177-185. refs (AAS PAPER 86-161)

The question of whether or not organic matter exists on Mars is examined, focusing on data from the Viking mission. The history of ideas concerning life on Mars is reviewed. Viking experiments included gas exchange, labeled release, and pyrolytic release experiments. The fact that no water or organic matter was found on Mars is discussed.

R.B.

A89-16185

A REAPPRAISAL OF LIFE ON MARS

GILBERT V. LEVIN (Biospherics, Inc., Rockville, MD) and PATRICIA A. STRAAT (National Institutes of Health, Bethesda, MD) IN: The NASA Mars Conference. San Diego, CA, Univelt, Inc., 1988, p. 187-208. refs (AAS PAPER 86-162)

The possibility that the labeled release experiment from the Viking mission provides evidence for life on Mars is discussed. The data and conclusions from the experiment are reviewed. It is found that there is no evidence for the existence of hydrogen peroxide on Mars and that if hydrogen peroxide were present, it would not have affected the experiment. It is suggested that the gas-chromatograph/mass spectrometer organic detection sensitivity could have missed low densities of organic matter. Possible evidence is given for the existence of lichen on Mars.

R.B.

N89-13144*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

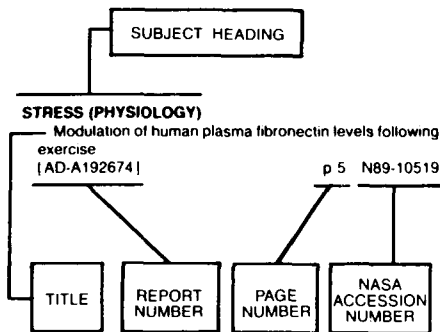
NASA NEWSLETTERS FOR THE WEBER STUDENT SHUTTLE INVOLVEMENT PROJECT

E. R. MOREY-HOLTON, P. D. SEBESTA, A. M. LADWIG, J. T. JACKSON, and W. M. KNOTT, III (National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.) Nov. 1988 317 p (NASA-TM-101001; A-88182; NAS 1.15:101001) Avail: NTIS HC A14/MF A01 CSDL 06C

Biweekly reports generated for the Weber Student Shuttle Involvement Project (SSIP) are discussed. The reports document the evolution of science, hardware, and logistics for this Shuttle project aboard the eleventh flight of the Space Transportation System (STS-41B), launched from Kennedy Space Center on February 3, 1984, and returned to KSC 8 days later. The reports were intended to keep all members of the team aware of progress in the project and to avoid redundancy and misunderstanding. Since the Weber SSIP was NASA's first orbital rat project, documentation of all actions was essential to assure the success of this complex project. Eleven reports were generated: October 3, 17 and 31; November 14 and 28; and December 12 and 17, 1983; and January 3, 16, and 23; and May 1, 1984. A subject index of the reports is included. The final report of the project is included as an appendix.

Author

Typical Subject Index Listing



The subject heading is a key to the subject content of the document. The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of document content, a title extension is added, separated from the title by three hyphens. The (NASA or AIAA) accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

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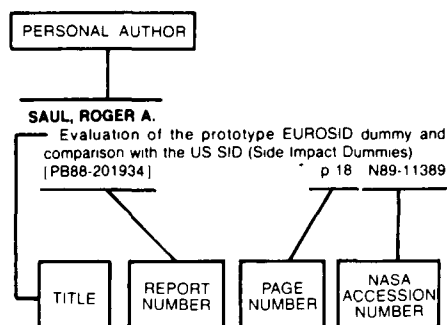
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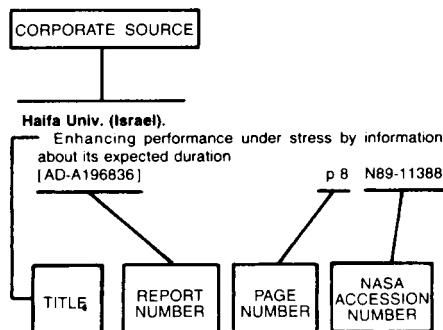
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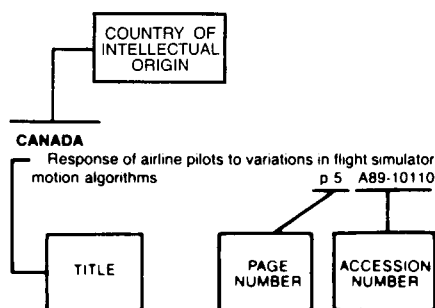
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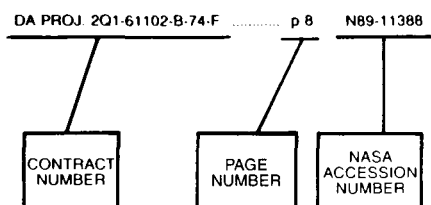
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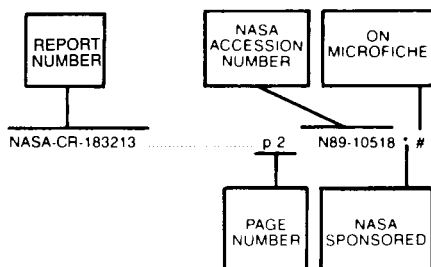
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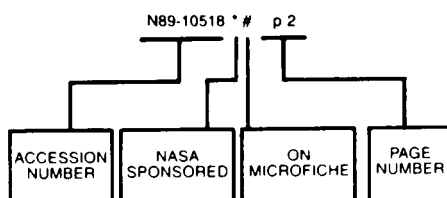
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